3M

Dynatel™ Advanced Modular System 965AMS

Version 4.01.17 User's Guide

Future-Proof Testing Platform

November 2010
78-8135-5011-4-D

Contents

Introduction

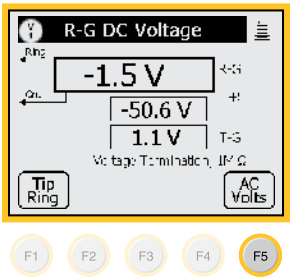
Getting Started

1. Press the red ON/OFF key to power up the unit or to power down the unit.

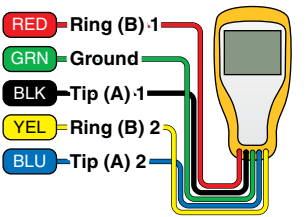
2. Press the ☼ key to change the contrast. Use the ▲ or ▼ keys to adjust the contrast on the screen.

3. F1 through F5 are the soft keys. Their function is displayed in the box above the key.

   Example: To use the AC Volts, press F5.

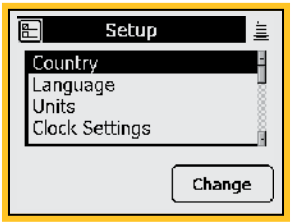


4. At the beginning of each chapter there will be a wiring diagram showing the test lead hook-up. The screen will also show the test lead hook-up.



Getting Started

5. Some screens require you to choose from a list of possible choices.

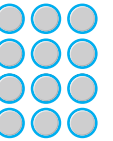


Use the up and down arrow keys to make your choice.

6. Other screens may allow you to enter information such as telephone numbers.

You can position the cursor by using the Left and Right arrow keys.

7. This symbol indicates you should use the blue keys to enter numeric values or numbers.

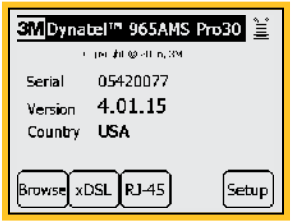


Getting Started

8. Use the ESC (escape) key to quit the current screen without making any changes. Use multiple escapes to return to the Welcome screen.
9. The **battery symbol** in the upper right-hand corner of the display gives an indication of the approximate battery capacity. Each bar represents one-quarter of the full capacity.
10. The unit is powered by a rechargeable NiMH battery pack. The unit will also work with the “AA” battery pack. Six “AA” batteries are required. Dispose of the batteries per your company procedures. See *Care & Maintenance* for more information on using the rechargeable battery pack.

Welcome Screen

This is the screen that you see when you first turn on the tester. It shows the model name, serial number, software version, and selected country.

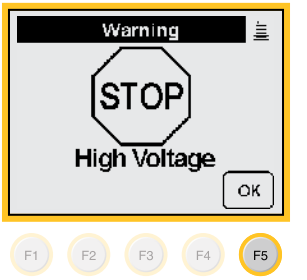


Help

Press the ? key at any time in any screen to get help with the current function. Press OK or ESC to return to the previous screen.

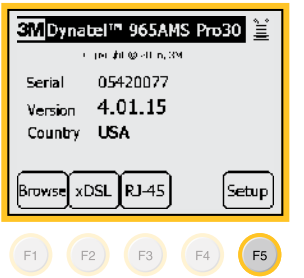
High Voltage

This screen indicates a high voltage (120 VAC/VDC or greater) has been detected between the test leads when not in the Voltage Mode. The tester has opened an internal relay to protect itself from damage. Use standard safety practices for disconnecting the test leads since high voltage may be present. Press OK to restart the 965AMS tester.



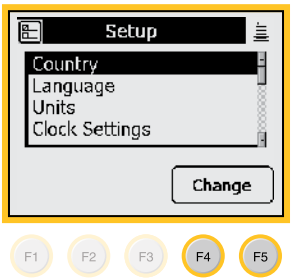
System Setup

Start with the Welcome Screen. Press Setup to review the global settings or to make changes.



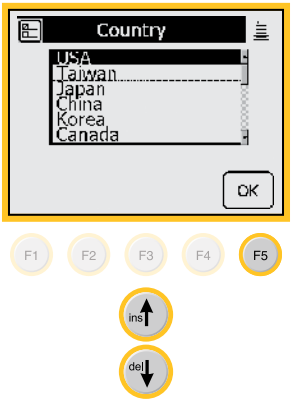
Country

1. Use the **Country** setup to configure the tester for a specific country. Selecting a new country will configure the tester with the setups for language, units, clock format, wire gauges, and cable types for that particular country. Press Change to make changes or to review the current settings.



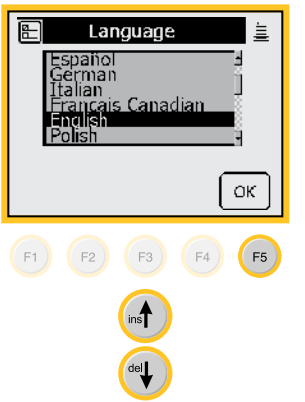
Country

2. Use the up and down arrow keys to highlight a country. You will be warned about changing country-specific default values and asked to confirm or cancel your selection. Press OK to continue or press ESC to quit without making changes.



Language

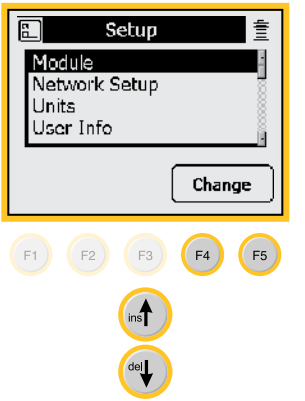
1. Use the **Language** setup to change only the language in the tester. Country-specific default values are not affected. Use the up and down arrow keys to highlight a new language. Press OK to continue or press ESC to quit without making changes.



Module

1. Use the **Module** setup to select the type of module that is installed in your tester. The module type is listed on the label on the module.

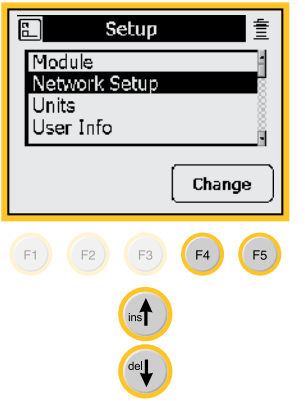
   Use the up and down arrow keys to highlight Module. Press Change to make changes or to review the current settings.



Network Setup

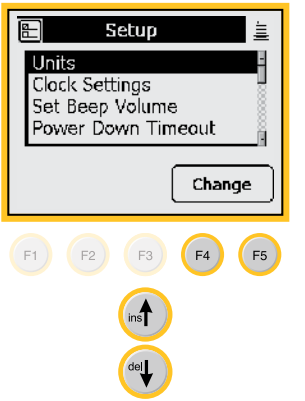
1. Use **Network Setup** to change network options used to connect to computers or ADSL circuits.

   Use the up and down arrow keys to highlight Network Setup. Press Change to make changes or to review the current settings.



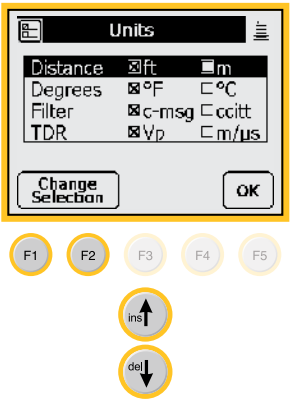
Units

1. Use the **Units** menu to change the Units of Measure. Use the up and down arrow keys to highlight Units. Press Change to continue or press ESC to quit without making changes.



Units

2. Use the up and down arrow keys to select the units you want to change. Press [Change Selection] to change the units of measure. An "X" in a box indicates your choice.



Distance: Feet or Meters: This affects all distances displayed in the 965AMS tester.

Degrees: Fahrenheit or Centigrade: This affects all temperatures used in the 965AMS tester.

Filter: C-Message or CCITT: This affects the filter used in the POTS Noise function. Use the C-Message filter in the US and Canada. Use the CCITT (also called "Psophometric") filter in all other countries.

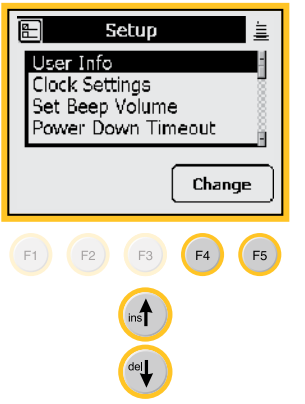
The 965AMS tester features a dBrnP filter for noise tests in New Zealand. To set the default noise filter to dBrnP, set Filter option to CCITT. This filter is used only in units sold in New Zealand; for all other countries, the CCITT option uses a dBrnOp filter. Noise test results will be displayed as dBrnP.

TDR: Vp (Velocity Propagation) or m/µS (meters per microsecond): This affects the TDR "velocity of propagation." Use "Vp" in the US and Canada. Use "m/µS" in other countries. Press [OK] to accept any changes and return. Use the esc key to return to the Welcome Screen without making changes.

User Info

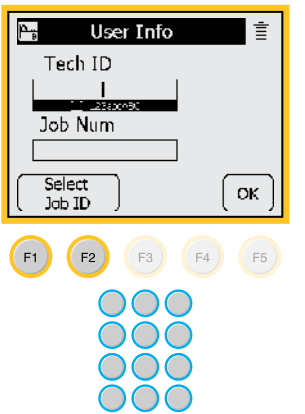
1. Select **User Info** to add your Tech ID and job number to be added to saved test results.

   Use the up and down arrow keys to highlight User Info. Press Change to make changes or to review the current settings.



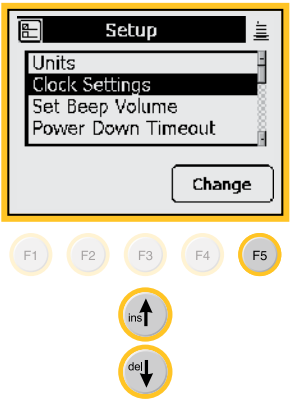
2. Use the blue keys to enter your ID, name, etc. Press Select Job ID to highlight the Job Num field.

   Use the blue keys to enter a job number or ID. Press OK to continue or press ESC to quit without making changes.

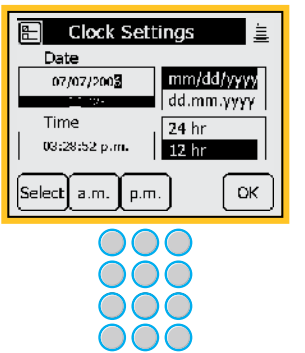


Clock Settings

1. Use the **Clock Settings** menu to select the clock format and to set the correct time. Use the up and down arrow keys to highlight Units. Press OK to continue or press ESC to quit without making changes.

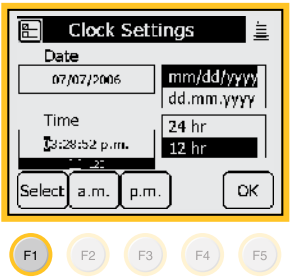


2. Use the blue keys to enter the correct date.

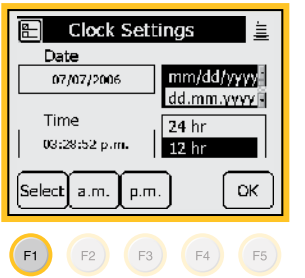


Clock Settings

3. Press **Select**, then enter the correct time using the blue keys.



4. Press **Select** to enter the date format. Choose month, day, year or day, month, year.

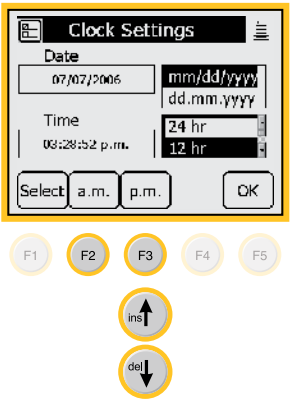


Clock Settings

5. Press Select to choose the 12-hour or 24-hour format. Use the up and down arrow keys to select the format.

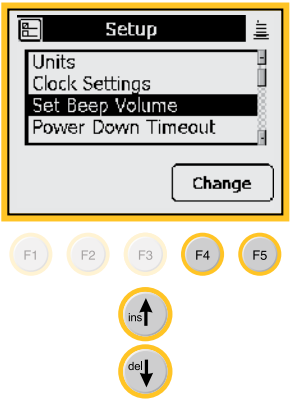
   If you choose the 12-hour format, press a.m. or p.m.

   Note: Press OK at any time that you have completed your updates.

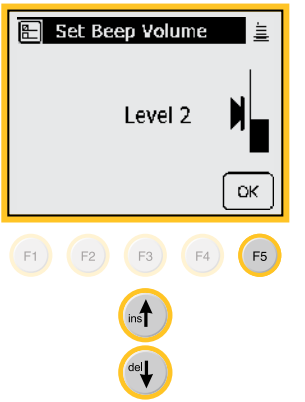


Set Beep Volume

1. Use this menu to change the **Set Beep Volume**. Use the up and down arrow keys to highlight Set Beep Volume. Press Change to continue or press ESC to quit without making changes.

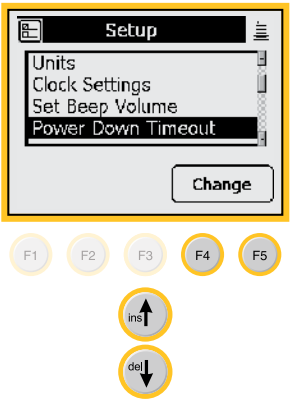


2. Use the up and down arrow keys to change the beep volume. Press OK to save this volume setting.

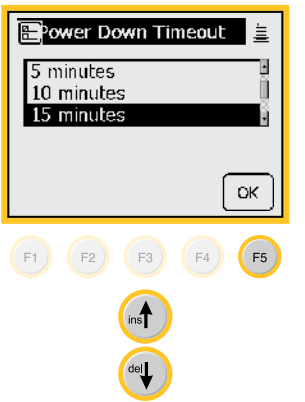


Power Down Timeout

1. Use this menu to change the **Power Down Timeout**. Use the up and down arrow keys to highlight Power Down Timeout. Press Change to continue or press ESC to quit without making changes.



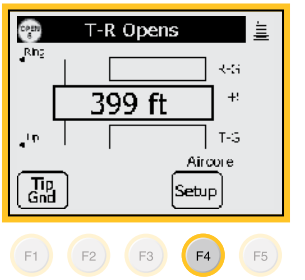
2. Use the up and down arrow keys to select the timeout you want to use. Press OK to save your choice.



Custom Cable

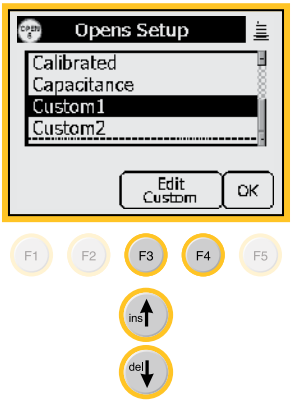
Use **Custom Cable 1** or **Custom Cable 2** to create a special cable you are using on a regular basis that has capacitance values that are different from existing cables. You can also access this function in the Opens Setup menu.

1. Press the blue OPEN 5M key to enter the Opens measurement function.
2. Press Setup to enter the Setup menu.



3. Use the up and down arrow keys to select Custom 1 or Custom 2.

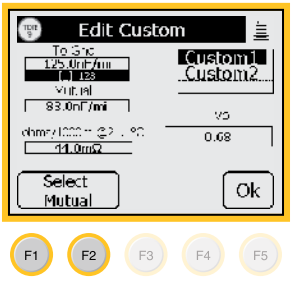
   Press Edit Custom.



Custom Cable

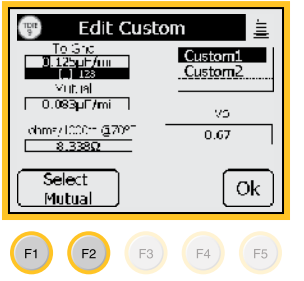
4. Use the blue keys to enter the capacitance to ground.

   Press **Select Mutual**.



5. Use the blue keys to enter the mutual capacitance.

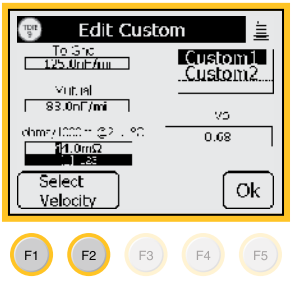
   Press **Select Ohms**.



Custom Cable

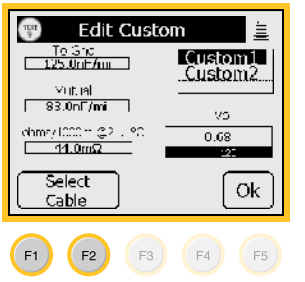
6. Use the blue keys to enter ohms per thousand feet.

   Press Select Velocity.



7. Use the blue keys to enter the velocity propagation. If you do not know this value, use 0.68.

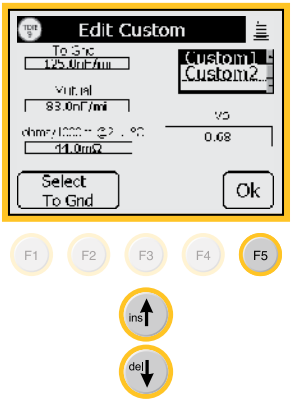
   Press Select Cable.



Custom Cable

8. Use the up and down arrow keys to select Custom 1 or Custom 2.

   Press OK to save the custom cable.

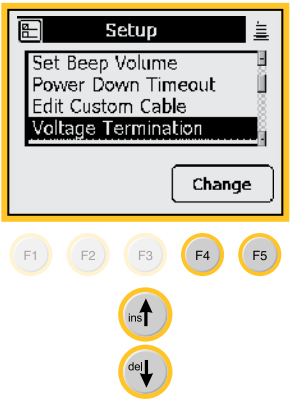


Voltage Termination

1. The **Voltage Termination** option allows you to select the input impedance of the 965AMS digital voltmeter (in supported countries only). The input impedance of the internal 965AMS voltmeter is normally 1Mohm. However, some legacy systems use voltage measurement systems with input impedances of 100Kohms. This option is provided to maintain measurement compatibility with those systems.

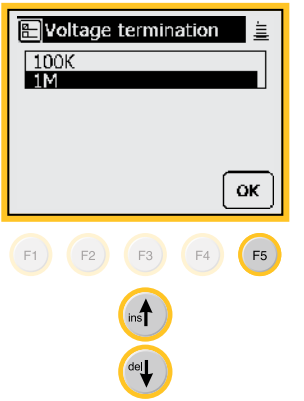
   If 100Kohm termination is selected, the 965AMS tester will display '100K' on the voltage measurement.

   Use this menu to change the Voltage Termination. Use the up and down arrow keys to highlight Voltage Termination. Press Change to continue or press ESC to quit without making changes.



Voltage Termination

2. Use the up and down arrow keys to select the Voltage Termination you want to use. Press OK to save your choice.



Measurement Functions

The 12 measurement functions include:

DC and AC voltage measurements

milliAmps and ground resistance measurements

Ohms measurement and Soak Test

Self-Calibrate, Stored Results and Ohms-to-Distance Calculator

Opens distance measurement

Send Tones

Resistance Fault Locate: Distance measurement to a resistive fault

DSL Loss and Noise plus the Spectrum Analyzer and Resistance Balance

Time Domain Reflectrometer (TDR)

POTS Loss, Noise, Longitudenal Balance, Load Coil Counter and Caller ID

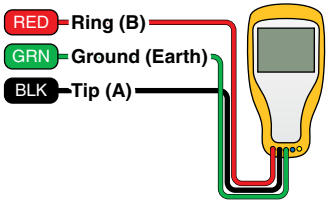
Automatic testing of circuits using “Expert Pair Tests”

Talk Set

Volts-DC or AC

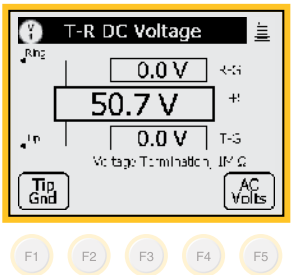
The **Volts** function measures the DC voltage or AC voltage between Tip, Ring and Ground.

Volts-DC or AC>**Hook-Up**

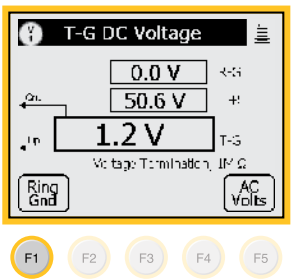


Volts-DC or AC>**Operation**

1. Press the blue key to start the voltage measurement function.
2. This screen displays the T-R voltage in the larger active measurement box.

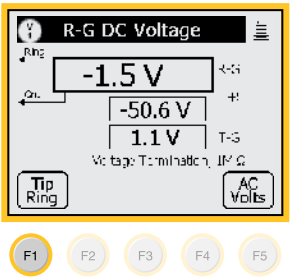


3. Press Tip Gnd to display the T-G voltage. The T-R measurement will be saved on the screen in a smaller box until a new measurement updates the screen.



*Volts-DC or AC>**Operation***

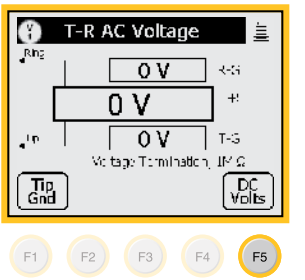
4. Press **Ring Gnd** to display the R-G voltage. The T-G measurement will be saved on the screen in a smaller box until a new measurement updates the screen.



5. All measurements are erased when you exit this function.

*Volts-DC or AC>**AC Volts***

1. Press **AC Volts** to measure AC volts.



AC Normal Range—Active Line:

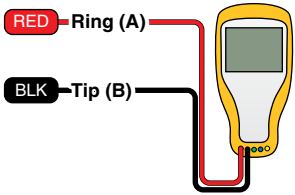
1. R-G and T-G should have the same AC voltage. If they are not equal the pair will probably have noise.
2. T-R should be 0 volts

Note: Maximum voltage = 300 volts DC, 250 volts AC

Loop Current

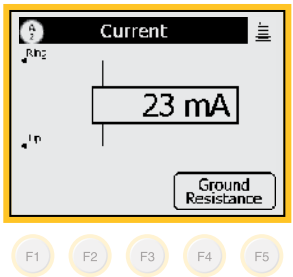
Loop Current (A 2abc) measures the loop current in an active line.

Loop Current>**Hook-Up**



Loop Current>**Operation**

1. Press the blue (A 2abc) key to start this test.
2. This is a continuous measurement until you disconnect the test leads or choose another function.



Normal Measurements

	OK	Marginal	Not OK
Current	>23mA	20-23mA	<20mA

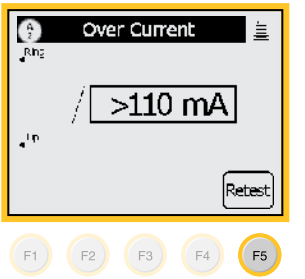
*Loop Current>**Operation***

3. **Over Current Warning**

   The tester has detected a current greater than 110 mA.

   Over current can damage the test set. Use standard safety practices for disconnecting the test leads and eliminating the source of the over current.

   Disconnect all test leads then press Retest to continue.

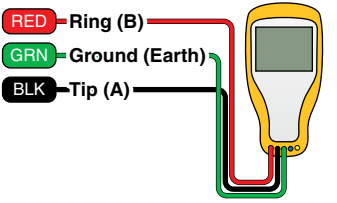


*Loop Current>**Ground Resistance***

The Ground Resistance function compares the customer protector ground resistance to an active central office pair.

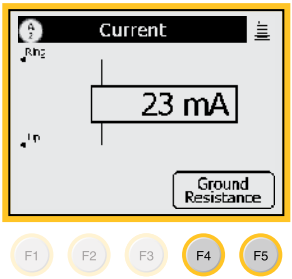
Note: The Ground Resistance function only works with central offices with the Tip connected to ground.

*Loop Current>Ground Resistance>**Hook-Up***

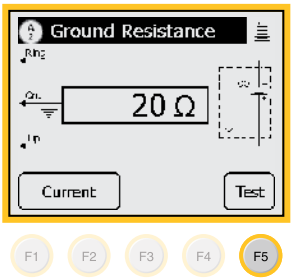


1. Press the blue A 2abc key to start this test.

   Press **Gnd Resistance** to access the Ground Resistance function.



2. Press **Test** to start the test. The results will be displayed in the box in the center of the screen.
3. This is not a continuous test. Press **Test** to see an updated result.



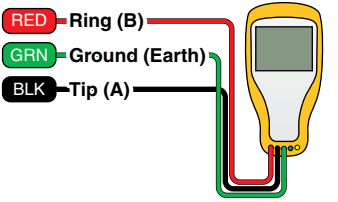
Normal Measurements

0 Ω to 25 Ω

Ohms Measurements

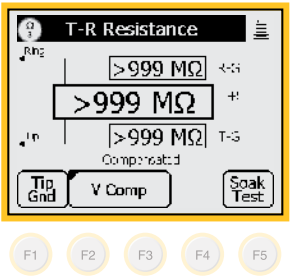
The **Ohms Measurement** function measures the insulation resistance between the Tip, Ring and Ground. This function can also measure the resistance of the Tip and Ring loop or individual wires.

Ohms Measurements>**Hook-Up**

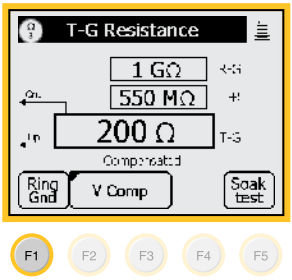


Ohms Measurements>**Operation**

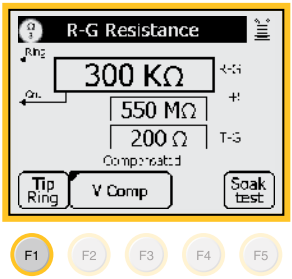
1. Press the blue key to start the ohms measurement function.
2. This screen displays the T-R resistance in the larger active measurement box.



3. Press **Tip Gnd** to display the Tip-Ground resistance. The T-R measurement will be saved on the screen in a smaller box until a new measurement updates the screen.



4. Press **Ring Gnd** to display the Ring-Ground resistance. The T-G measurement will be saved on the screen in a smaller box until a new measurement updates the screen.



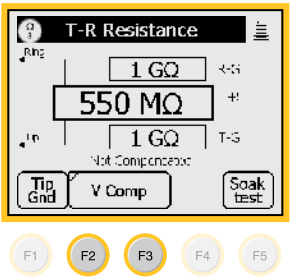
5. All measurements are erased when you exit this function.

Normal Range: POTS Insulation Resistance

	OK	***Marginal***	***Not OK***
Insulation Resistance	>3.3 MΩ	80 kΩ to 3.3 MΩ	<80 kΩ

*Ohms Measurements>**Voltage Compensation***

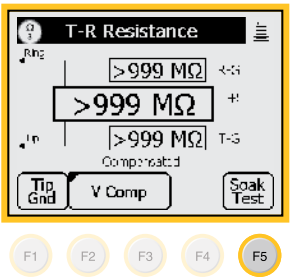
The Voltage Compensation feature compensates for crossed battery on the line. Use “compensated” for most measurements.



Press **V Comp** to turn voltage compensation off and on. The screen displays “Compensated” or “Not Compensated.”

*Ohms Measurements>**Soak Test***

The Soak Test function can determine if the source of a resistive fault is caused by moisture, corrosion or pure resistance by applying a current to the circuit and measuring a change in resistance.



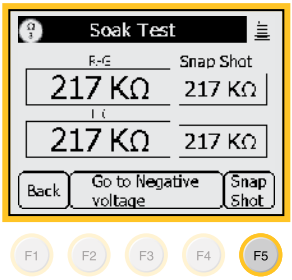
Press **Soak Test** to access the Soak Test menu.

NOTE: The Soak Test function will not work properly if there is voltage on the line. Voltage Compensation does not apply to the Soak Test.

Ohms Measurements>**Soak Test**

1. Take an initial resistance measurement by pressing the Snap Shot key.

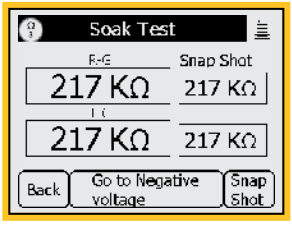
2. You will compare this to other active measurements to determine the source of the fault.



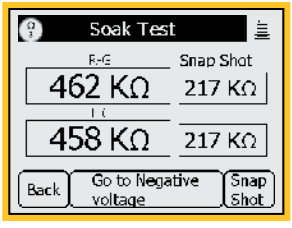
3. One of the properties of moisture in a circuit is that the current from the tester can "dry out" the moisture. The display will first show a lower resistance, then after one or two minutes the resistance will increase to a higher reading.

   This indicates the fault is caused by moisture.

   Note: This is not an acceptable procedure to "dry" a fault.

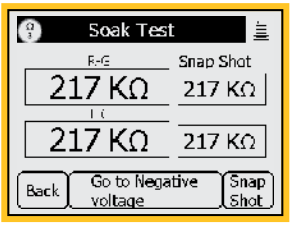


Initial Reading

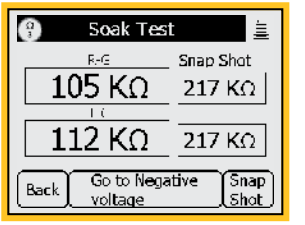


Reading After 1 or 2 Minutes

4. A property of corrosion is that a current flowing through the corrosion will cause the corrosion to become a better conductor. The display will show a lower resistance reading if corrosion is the cause.

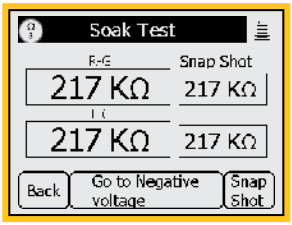


Initial Reading

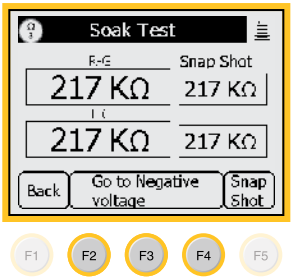


Reading After 1 or 2 Minutes

5. If the resistance value does not change, the fault is a pure resistive fault.



6. Use **Go To Positive Voltage** and **Go To Negative Voltage** to reverse the voltage polarity. Use the lowest resistance reading of the two numbers for your measurements.



Toolbox

Use the Toolbox (TOOLS 4 gh) (4 gh) to: (1) view saved test results, (2) perform a self calibrate, (3) use the Ohms to Distance calculator, (4) use Internet Explorer and (5) Upload results to the 965AMS Results Manager.

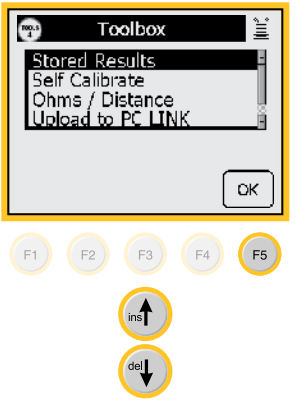
Toolbox>**Stored Results**

The **Stored Results** function allows you to review the results of previously saved tests.

Toolbox>Stored Results>**Operation**

1. Press the blue (TOOLS 4 gh) (4 gh) key to enter the Toolbox function.

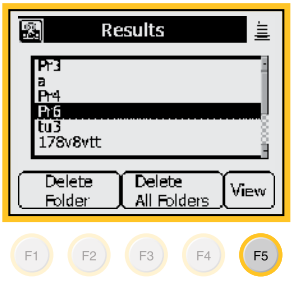
   Use the up and down arrow keys to select the Stored Results function. Press OK to save your choice.



2. If one or more test results have been stored, the ID number for each will be displayed.

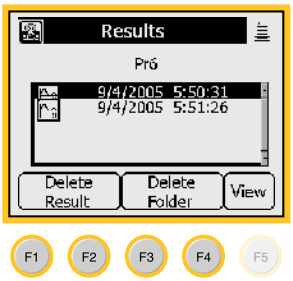
   The ID number is like a file folder and each test result is like a file. The name of the file is the time and date stamp that is generated by the tester.

   Press **View** to see the list of files.



3. This screen shows the contents of the file.

   Press **Delete Result** to delete one file or press **Delete Folder** to delete all files in the folder.

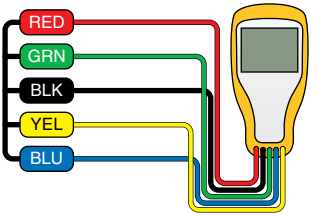


*Toolbox>**Self-Calibrate***

The **Self-Calibrate** function will verify that all of the internal circuits and test leads are operating properly. Use self-calibrate:

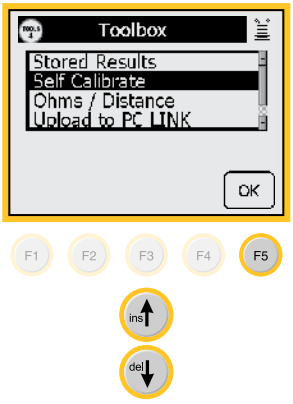
- After the first full battery charge before you put the tester in service for the first time.
- Anytime the working temperature changes by more than 35°F (20°C). Calibrate the 965AMS tester at the same temperature at which it will be used.
- After changing the batteries, or anytime the battery pack completely discharges.

*Toolbox>Self-Calibrate>**Hook-Up***

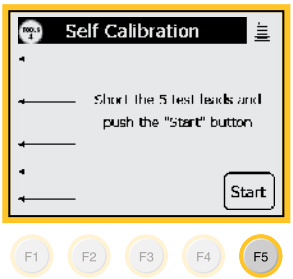


All five leads are shorted together.

1. Press the blue TOOLS 4 ghi / X1 4 ghi key to enter the Toolbox function.
2. Use the up and down arrow keys to select the Self-Calibrate function. Press OK to save your choice.



3. The calibration may take up to 1 minute to complete.

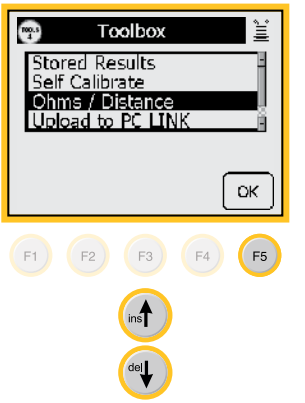


*Toolbox>***Ohms-to-Distance Calculator**

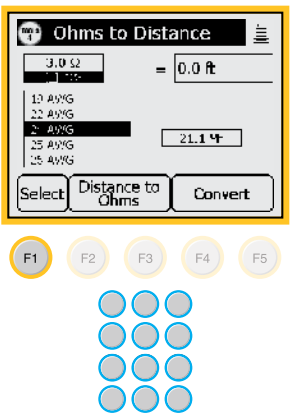
Use this function to convert from Ohms to Distance or Distance to Ohms based on temperature and wire gauge.

*Toolbox>Ohms-to-Distance Calculator>***Operation**

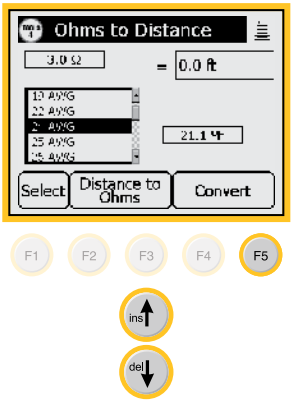
1. Press the blue TOOLS key to enter the Toolbox function.
2. Use the up and down arrow keys to select the Ohms-to-Distance Calculator. Press OK to save your choice.



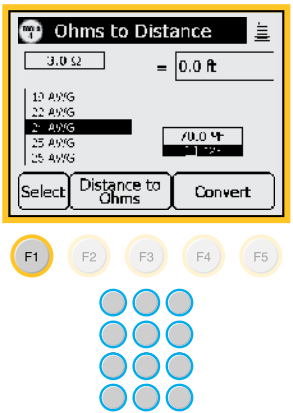
3. Use the blue keys to enter the Ohms value. Press Select to save and highlight the wire gauge selection.



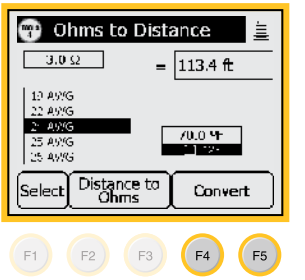
4. Use the up and down arrow keys to select the wire gauge. Press **Select** to save and highlight the temperature field.



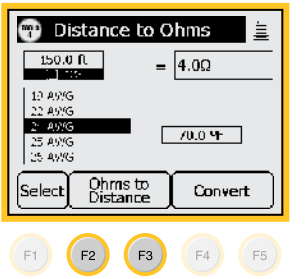
5. Use the blue keys to enter the temperature.



6. Press **Convert** to find the distance.

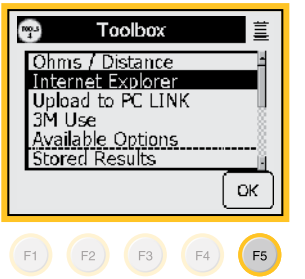


7. Select **Distance to Ohms** if you want to convert a distance to an Ohms value.



Internet Explorer

1. **Internet Explorer** is available on the VDSL2 module.
2. Use the up and down arrow keys to select Internet Explorer. Press **OK** to save your choice.



Toolbox>**965AMS Results Manager**

The 965AMS tester uses the **965AMS Results Manager** to upload and convert files from the tester. The following files are supported by the 965AMS Results Manager:

- Single Trace TDR
- Active POTS Autotests
- Vacant POTS Autotests
- Wideband Autotests
- xDSL Link Metrics
- xDSL Bin Graphs

Note: Only results listed above will be converted using the 965AMS Results Manager.

Toolbox>965AMS Results Manager>**Software Installation**

Visit *www.3m.com/dynatel* to find the latest 965AMS Results Manager.

You will need to install the following software before using the Results Manager:

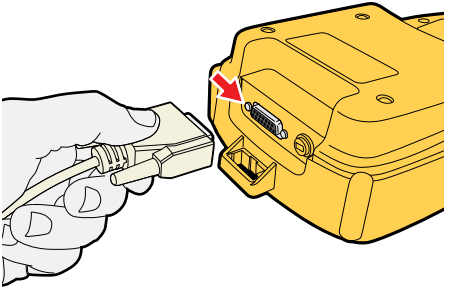
1. The following Microsoft software:
   a. DotNetFX 2.0 or higher
   b. Activesync 4.2 or higher

Note: Visit* www.microsoft.com *and search for each file download.

2. The following 3M software will be needed.
   a. 3M_Usb_Driver
   b. 965AMS Results Manager

Note: Visit* www.3m.com/dynatel *to download the files.

1. Turn on the 965AMS tester and allow the unit to boot up.
2. Connect the 965AMS tester to power.
3. Connect the 965AMS tester to the PC via the USB to 15-pin cable.



Note: If the "Welcome to Found New Hardware Wizard" window appears then select "No, not this time" when asked about connecting to Windows Update.

4. Select "No" when prompted to Set Up a Partnership.

Toolbox>965AMS Results Manager>**Copying Files**

To copy files that are saved in a 3M Dynatel 965AMS:

1. Click on the file labelled 965AMS_Results_Manager.exe.
2. Press the Copy All XML_Results Files From 965AMS to PC.
3. You can also delete all the files on the PC.

Note: Wait until you have verified that you are finished with the files before deleting.

4. After you have selected a directory to save the files you will see a progress bar and a notification of completion when finished.

Toolbox>965AMS Results Manager>**Converting Upgraded Files**

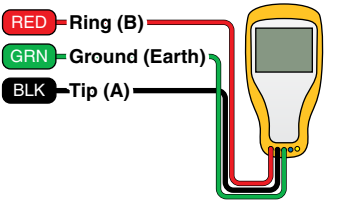
To convert your saved files to HTML:

1. Start the 965AMS Results Manager.
2. Click on the tab labeled “Files on PC.”
3. Press the “Convert XML Results Files on PC to HTML for viewing.”

Opens

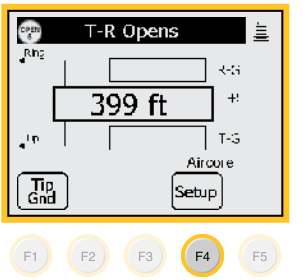
Opens (OPEN 5kt) (5kt) measures the distance to an "open" circuit. This could be a broken wire, a cut pair or the end of the circuit.

Opens>**Hook Up**

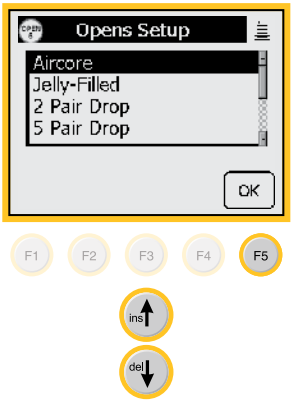


Opens>**Operation**

1. Press the blue (OPEN 5kt) (5kt) key to enter the Opens measurement function.
2. Press Setup to enter the Setup menu.

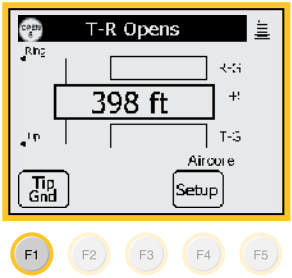


3. Use the up and down arrow keys to choose the type of cable that best describes your cable. Press OK to save your choice.



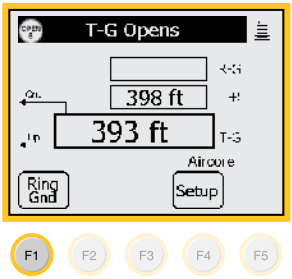
4. This screen displays the T-R distance in the larger active measurement box.

   Press Tip Gnd to display the T-G distance.

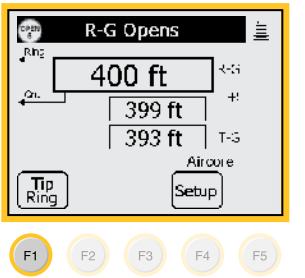


5. The T-R measurement will be saved on the screen in a smaller box until a new measurement updates the screen.

   Press Ring Gnd to display the R-G distance.



6. The T-G measurement will be saved on the screen in a smaller box until a new measurement updates the screen.



7. All measurements are erased when you exit this function.

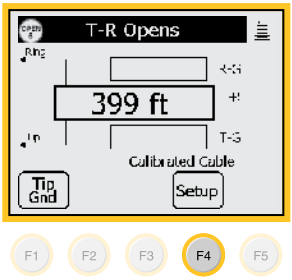
Normal Range: A good pair should have the T-G and R-G within about 2% of each other. If they are not within 2%, the shortest distance will be the location of the fault and the other distances will not provide accurate distances. Typically this will be an open ground bond or a broken Tip or Ring.

Note: "Opens" is more accurate if other cable pairs are active. If other pairs are not active, short at least 30% of the inactive pairs to the cable shield.

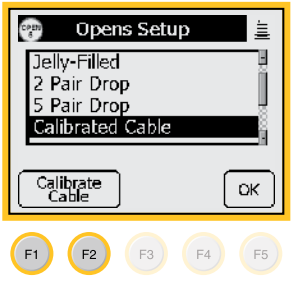
Opens>**Calibrate Cable**

Use this function to measure the capacitance of a known good pair within a cable of known length. This value can be used as a ‘Calibrated Cable’(or ‘reference’) to find the distance to an ‘open’ on the same or similar cable.

1. Press **Setup**.



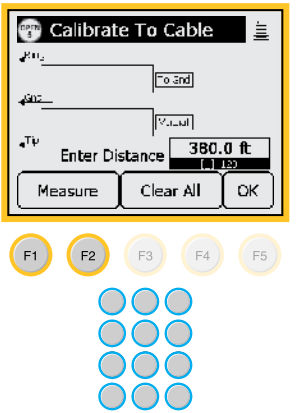
2. Press **Calibrate Cable**.



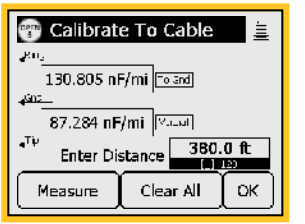
*Opens>**Calibrate Cable***

3. Use the blue keys to enter the known distance.

   Press **Measure**.



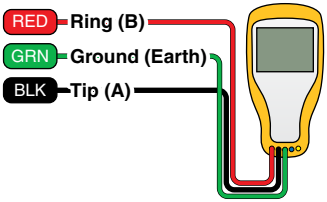
4. The screen will display the measured capacitance per distance for the reference pair.



Tone

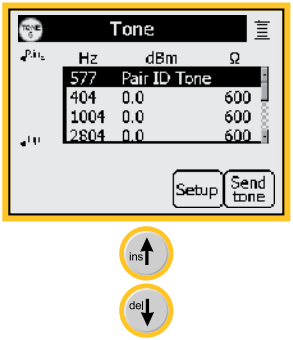
Use **Tone** to send a tone on a pair.

Tone>**Set-Up**

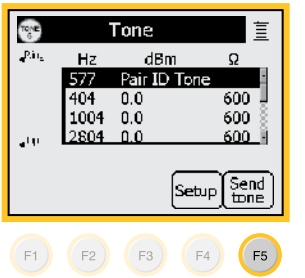


Tone>**Operation**

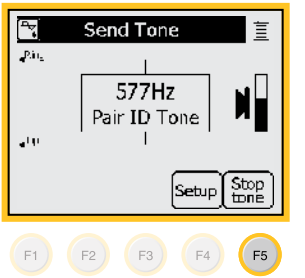
1. Press the blue TONE key to enter the Tone function.
2. Use the up and down arrow keys to highlight the frequency that you want to use.



3. Press **Send Tone** to send the tone.



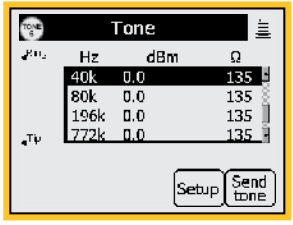
4. Press **Stop Tone** to stop the tone.



Tone>**Edit The Frequency Of A Tone**

There are 10 frequencies that can be stored in memory. If you need a different frequency you can edit any of the displayed frequencies and change to a new frequency.

1. Use the up and down arrow keys to select one of the frequencies to change.



2. Press Setup to adjust the highlighted selection with the following frequency range:

   ID - 200 Hz and 1,000 Hz

   Precision - 200 Hz and 19,999 Hz

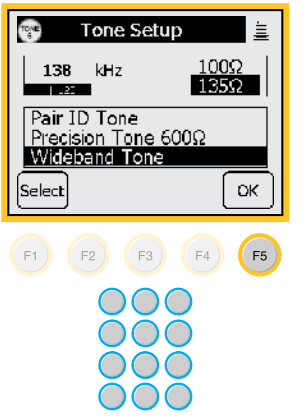
   Wideband (965AMS Pro tester 2) - 20 kHz and 2200 kHz.

   (965AMS Pro 30 tester) - 20 kHz and 30 MHz.

3. For this example we will replace 196 kHz with 138 kHz. Use the up and down arrow keys to select Wideband Tone.

*Tone>**Edit The Frequency Of A Tone***

4. Use the blue keys to enter the frequency in kHz.
5. Press OK.



*Tone>**Applications***

The Tone function can be used for three applications: **ID Tone, Precision Tone** and **Wideband Tone.**

*Tone>Applications>**ID Tone***

1. Use the **ID Tone** for pair identification and tone coiling.
2. The ID tone is always an interrupted tone.
3. The frequency is adjustable between 200 Hz and 1,000 Hz.
4. The 965AMS tester automatically goes off-hook when an ID tone is sent.
5. The volume control on the 965AMS tester controls the volume you hear, but the output to the far end is set at a fixed level.

Tone>Applications>**Precision Tone**

1. Use the **Precision Tone** to send a tone.
2. Use another 965AMS tester to receive the tone. Press the blue (POTS *) (☎ ∞ #) key, then select [Loss].
3. The output frequency of the Precision tone is adjustable between 200Hz and 19,999Hz.
4. The output level range is –20dBm to +1dBm.
5. The most common frequencies for POTS lines are 404Hz, 1004Hz and 2804Hz.
6. The impedance is fixed at 600Ω.
7. Press [Send Tone] to send the Precision tone.
8. Press [Stop Tone] to stop the Precision tone.

Tone>Application>**Wideband Tone**

1. Use the **Wideband Tone** to send a tone to the other end of a wideband circuit to measure the signal loss.
2. Use another 965AMS tester to receive the tone.
3. Press the blue (DSL 8 tuv) key, then select [DSL Loss].
4. The output frequency of the Wideband tone is adjustable between 20kHz and 2200kHz.
5. The output level is fixed at 0dBm.
6. The impedance can be set to 100Ω or 135Ω.
7. Press [Send Tone] to send the wideband tone.
8. Press [Stop Tone] to stop the wideband tone.

RFL (Resistance Fault Locate)

Use **RFL** to find the distance to a short or ground.

Important Note: You must first use the Auto test, or the Ohmmeter, to determine the type of fault.

1. There are two types of hook-ups, **Separate Pair** and **Single Pair**. Separate Pair is more accurate, but it requires hooking up more wires. The "Good" wires can be any gauge and any length. As an example, the Good wires can be jumper wire. Separate Pair is recommended for applications where you have a short or ground in an aerial cable or a direct buried cable and you want to find the fault the first measurement.

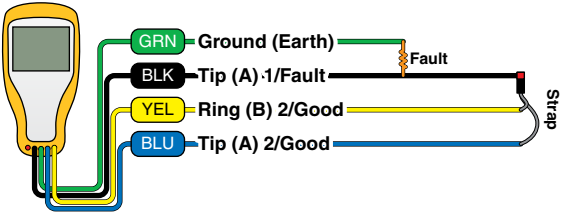
2. Single Pair requires that the "Good" wire is the same gauge and length as the faulted wire. Single Pair is appropriate for situations where you are looking for the fault to be in the nearest pedestal.

3. RFL has the ability to find the distance to a short or ground using a single section of cable or a section with multiple gauges. Select Single- or Multi-section for your situation.

RFL>**Hook-Up**

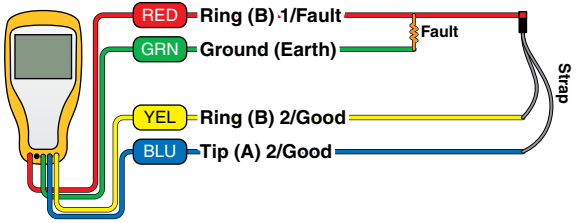
There are ten possible scenarios for connecting a 965AMS tester to use the RFL function:

Tip-Ground Separate Pair

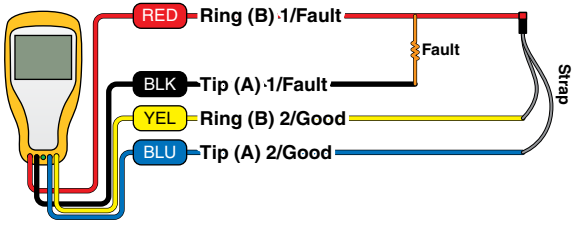


RFL>**Hook-Up**

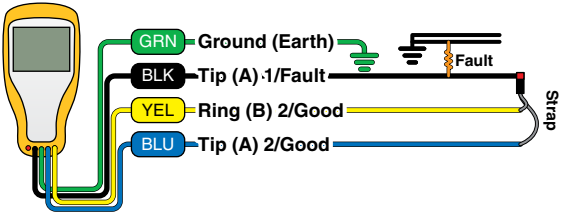
Ring-Ground Separate Pair



Short Separate Pair

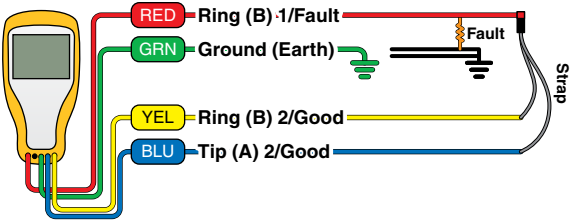


Tip-Cross Separate Pair

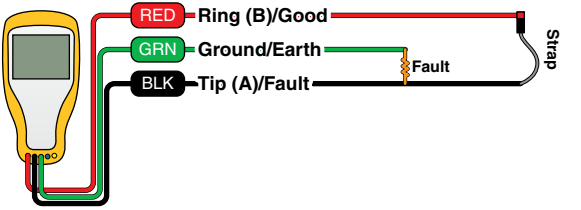


*RFL>**Hook-Up***

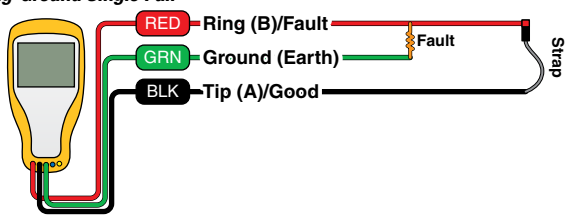
Ring-Cross Separate Pair



Tip-Ground Single Pair

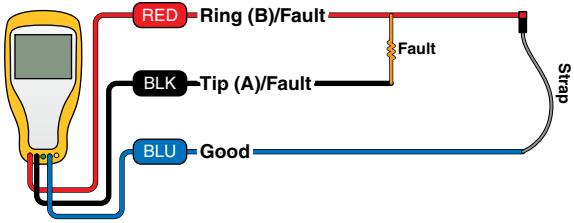


Ring-Ground Single Pair

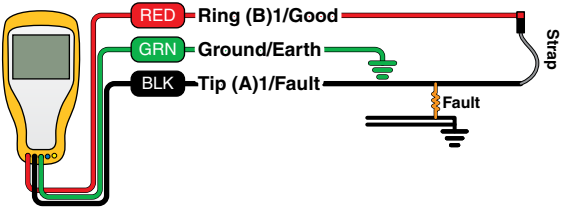


RFL>**Hook-Up**

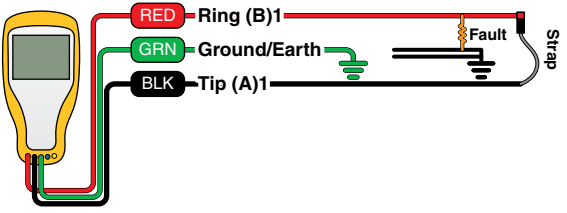
Short Single Pair



Tip-Cross Single Pair



Ring-Cross Single Pair



RFL>**Separate-Pair, Single-Section Operation**

1. Use the Auto test (AUTO 0), or the Ohmmeter (Ω 3 def), to determine the type of fault.

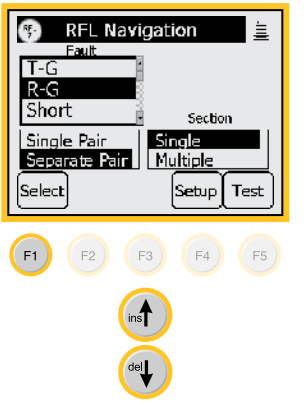
2. Press the blue RFL 7pgrs / 7pgrs key to enter the RFL function.

   Press **Select** until the Fault section is highlighted. Use the up and down arrow keys to select the type of fault that you have. The options include:

   Tip Cross, Ring Cross, Wet Pulp, T-G, R-G, Short

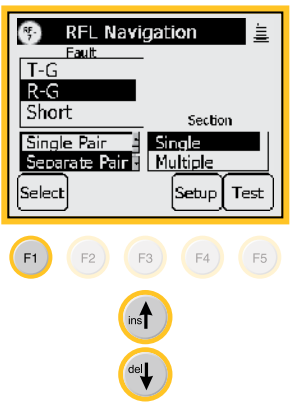
   This example will show a Ring-Ground fault.

   Press **Select** to move to the Pair section.



3. Use the up and down arrow keys to select Separate Pair.

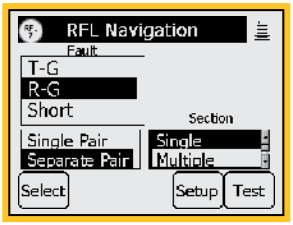
   Press **Select** to move to the Multiple-Single section.

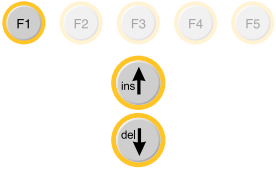


RFL>Separate-Pair, Single-Section Operation

4. Use the up and down arrow keys to select Single Section.

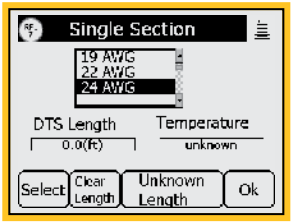
5. Press Setup to choose the measurement parameters.

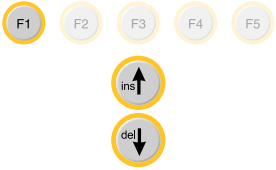




6. The first parameter is the gauge. Use the Up and Down arrow keys to highlight the gauge of your cable.

   Press Select to choose the cable length.

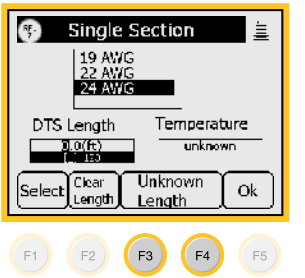




RFL>Separate-Pair, Single-Section Operation

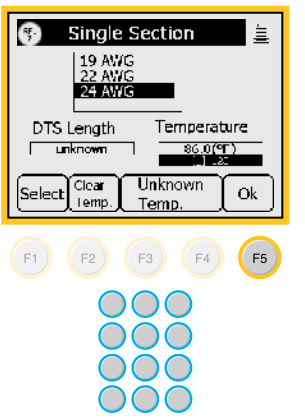
Special Requirement: Enter the cable temperature or the length, but not both. Only one parameter can be entered. There must be one unknown to solve the calculation.

For this example, we will use the cable temperature as the known value and the length will not be entered.



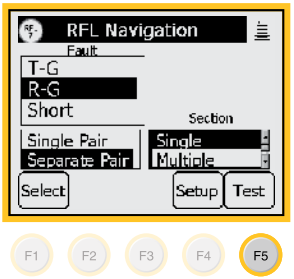
7. Press **Unknown Length** to enter an unknown length and highlight the Temperature section.
8. Enter the temperature using the blue keys.

   Press **OK** to return to the main RFL screen.

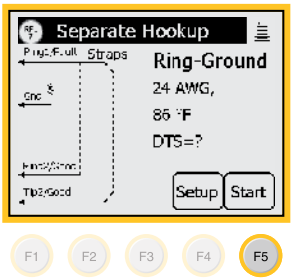


RFL>**Separate-Pair, Single-Section Operation**

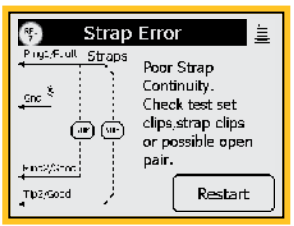
9. Press Test to review the settings.



10. This screen shows the test lead hook-ups and the settings you have selected. Press Start to begin the test.

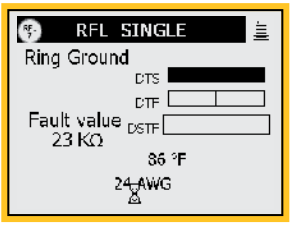


11. If the hook-up is not correct, you will see an error message on the wiring diagram at the point of the error.



*RFL>***Separate-Pair, Single-Section Operation**

12. During the measurement process, a bar graph of the null voltage for DTS and then for DTF will be visible on the screen.



13. The results of the measurements are displayed on the screen.

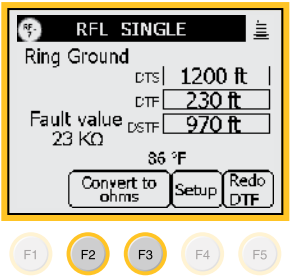
    DTS is the distance to the strap.

    DTF is the distance to the fault.

    DSTF is the distance from the strap to the fault.

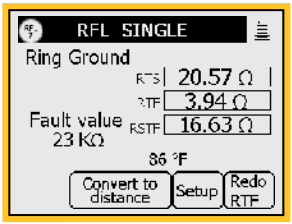
    This screen also displays the value of the fault.

    In some situations it may be more helpful to use the resistance values instead of the distance values. Press **Convert to ohms** to use the resistance values.



RFL>**Separate-Pair, Single-Section Operation**

14. Press **Convert to distance** to convert the resistance back to distance.



RFL>**Separate-Pair, Multi-Section Operation**

1. Use the Auto test (AUTO 0), or the Ohmmeter (Ω 3 def), to determine the type of fault.

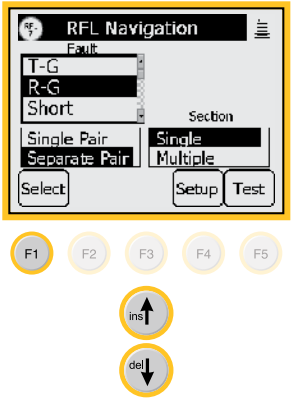
2. Press the blue (RFL 7 pqrs / 7 pqrs) key to enter the RFL function.

   Press **Select** until the Fault section is highlighted. Use the up and down arrow keys to select the type of fault that you have. The options include:

   Tip Cross, Ring Cross, Wet Pulp, T-G, R-G, Short

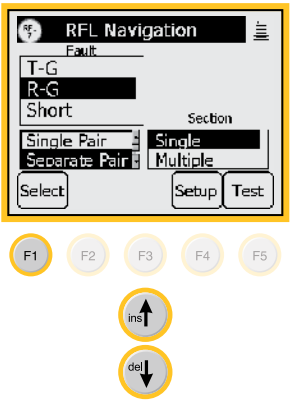
   This example will show a Ring-Ground fault.

   Press **Select** to move to the Pair section.

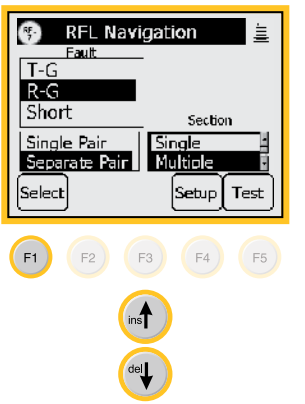


3. Use the up and down arrow keys to select Separate Pair.

   Press **Select** to move to the Multiple-Single section.

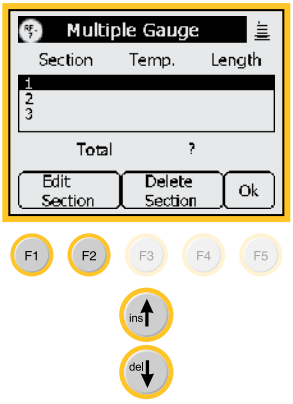


4. Use the up and down arrow keys to select Multiple sections of cable that have more than one gauge.
5. Press **Setup** to define the sections.



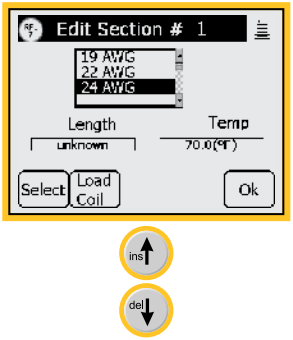
RFL>**Separate-Pair, Multi-Section Operation**

6. Use the up and down arrow keys to select a section. Press **Edit Section** to choose the measurement parameters.



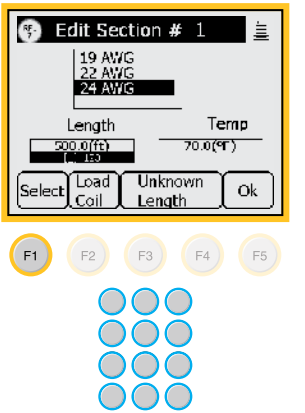
7. The first parameter is the gauge. Use the Up and Down arrow keys to highlight the gauge of your cable.

   Press **Select** to highlight the section length section.



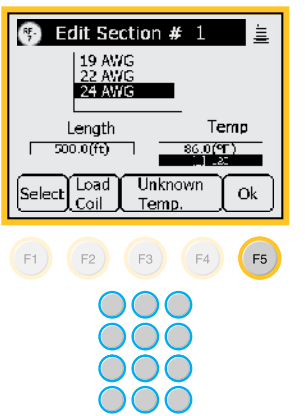
8. Use the blue keys to enter the section length.

   Press **Select** to move to the Temp section.



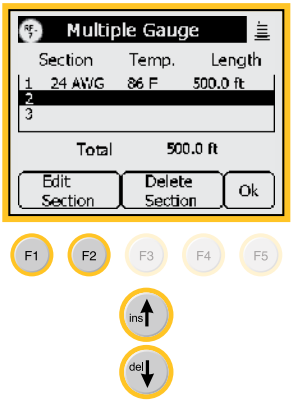
9. Use the blue keys to enter the cable temperature.

   Press **OK** to return to the Multiple Gauge screen.

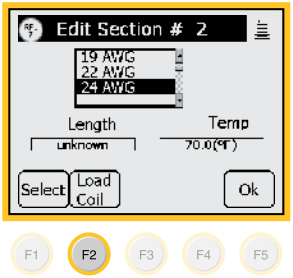


RFL>**Separate-Pair, Multi-Section Operation**

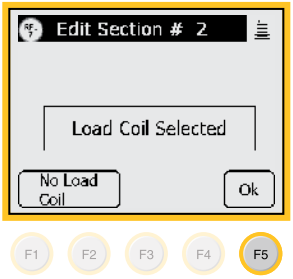
10. Use the up and down arrow keys to select the next section. Press **Edit Section** to choose the measurement parameters.



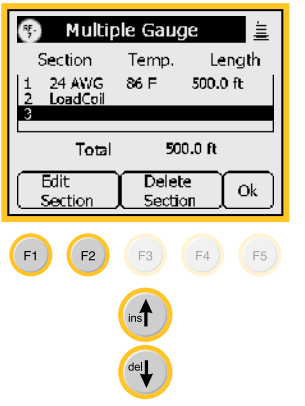
11. You can add a load coil to the calculations. Press **Load Coil** to add the H88 load coil to the section. You can add as many load coils as you need, but each one must be in a different section on the screen.



12. Press **OK** to store the load coil and return to the Multiple Gauge screen.

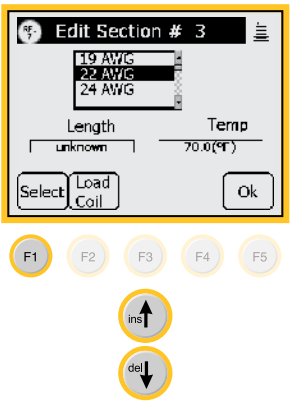


13. Use the up and down arrow keys to select the next section. Press **Edit Section** to choose the measurement parameters.



14. Use the Up and Down arrow keys to highlight the gauge of your cable.

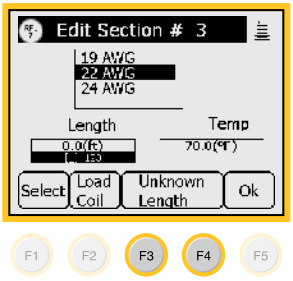
    Press **Select** to highlight the section length section.



RFL>Separate-Pair, Multi-Section Operation

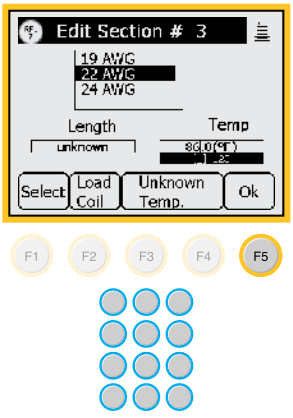
Special Requirement: Enter the cable temperature or the length, but not both. Only one parameter can be entered. There must be one unknown to solve the calculation.

For this example, we will use the cable temperature as the known value and the length will not be entered.

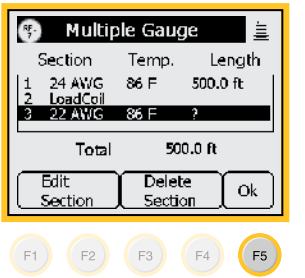


15. Press **Unknown Length** to enter an unknown length and move to the Temp section.
16. Use the blue keys to enter the cable temperature.

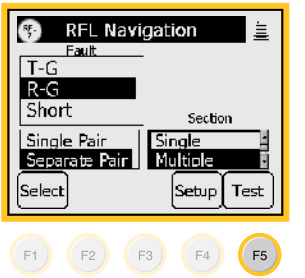
    Press **OK** to return to the Multiple Gauge screen.



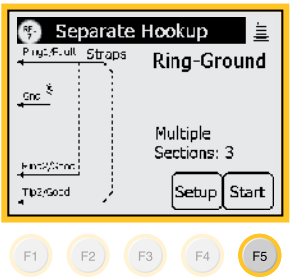
17. Press OK again to return to the main RFL screen.



18. Press Test to review the settings.

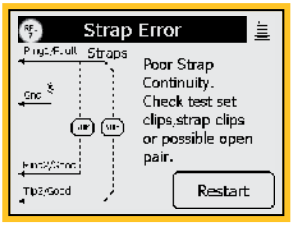


19. This screen shows the test lead hook-ups and the settings you have selected. Press Start to begin the test.

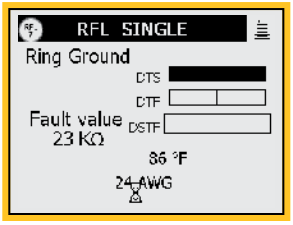


RFL>**Separate-Pair, Multi-Section Operation**

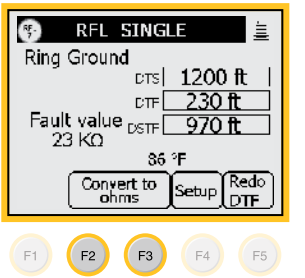
20. If the hook-up is not correct, you will see an error message on the wiring diagram at the point of the error.



21. During the measurement process, a bar graph of the null voltage for DTS and then for DTF will be visible on the screen.



22. The results of the measurements are displayed on the screen.



DTS is the distance to the strap.

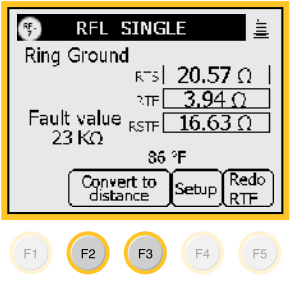
DTF is the distance to the fault.

DSTF is the distance from the strap to the fault.

This screen also displays the value of the fault.

In some situations it may be more helpful to use the resistance values instead of the distance values. Press **Convert to ohms** to use the resistance values.

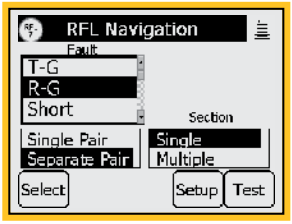
23. Press **Convert to distance** to convert the resistance back to distance.



RFL>**Single-Pair, Single-Section Operation**

1. Use the Auto test (AUTO 0), or the Ohmmeter (Ω 3 def), to determine the type of fault.

2. Press the blue (RFL 7pqrs) (7pqrs) key to enter the RFL function.

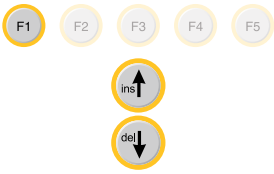


Press **Select** until the Fault section is highlighted. Use the up and down arrow keys to select the type of fault that you have. The options include:

Tip Cross, Ring Cross, Wet Pulp, T-G, R-G, Short

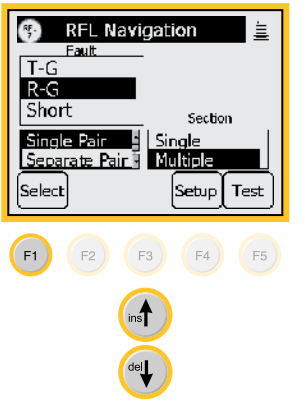
This example will show a Ring-Ground fault.

Press **Select** to move to the Pair section.



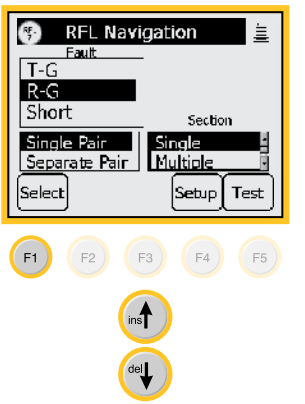
3. Use the up and down arrow keys to select Single Pair.

   Press **Select** to move to the Multiple-Single section.



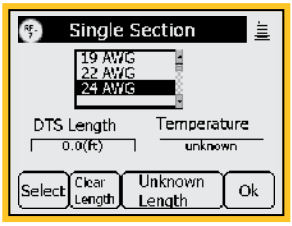
4. Use the up and down arrow keys to select Single Section.

5. Press **Setup** to choose the measurement parameters.



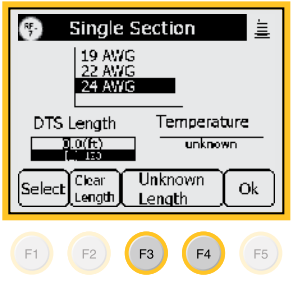
6. The first parameter is the gauge. Use the Up and Down arrow keys to highlight the gauge of your cable.

   Press **Select** to choose the cable length.



Special Requirement: Enter the cable temperature or the length, but not both. Only one parameter can be entered. There must be one unknown to solve the calculation.

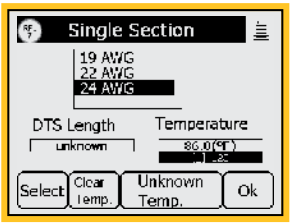
For this example, we will use the cable temperature as the known value and the length will not be entered.

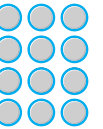


7. Press **Unknown Length** to enter an unknown length and move to the Temp section.

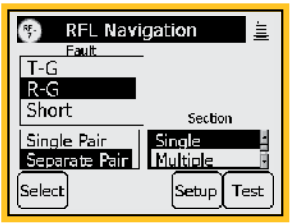
8. Enter the temperature using the blue keys.

   Press [OK] to return to the main RFL screen.



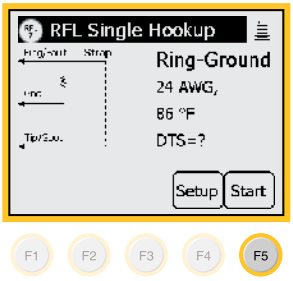


9. Press [Test] to review the settings.

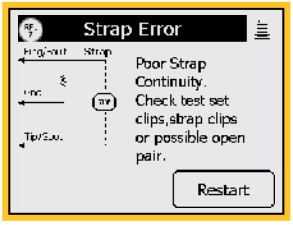


RFL>**Single-Pair, Single-Section Operation**

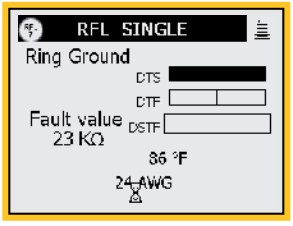
10. This screen shows the test lead hook-ups and the settings you have selected. Press Start to begin the test.



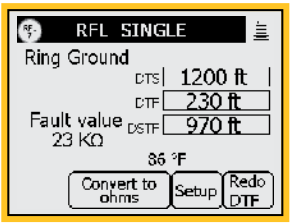
11. If the hook-up is not correct, you will see an error message on the wiring diagram at the point of the error.



12. During the measurement process, a bar graph of the null voltage for DTS and then for DTF will be visible on the screen.



13. The results of the measurements are displayed on the screen.



DTS is the distance to the strap.

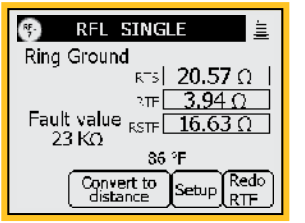
DTF is the distance to the fault.

DSTF is the distance from the strap to the fault.

This screen also displays the value of the fault.

In some situations it may be more helpful to use the resistance values instead of the distance values. Press **Convert to ohms** to use the resistance values.

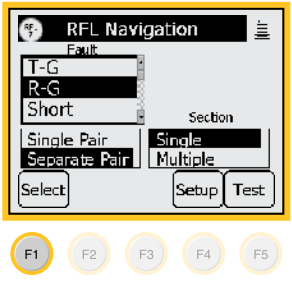
14. Press **Convert to distance** to convert the resistance back to distance.



RFL>**Single Pair, Multi-Section Operation**

1. Use the Auto test (AUTO 0), or the Ohmmeter (Ω 3 def), to determine the type of fault.

2. Press the blue (RFL 7pqrs) (7pqrs) key to enter the RFL function.



   Press **Select** until the up and down arrow keys are in the Fault section. Use the up and down arrow keys to select the type of fault that you have. The options include:

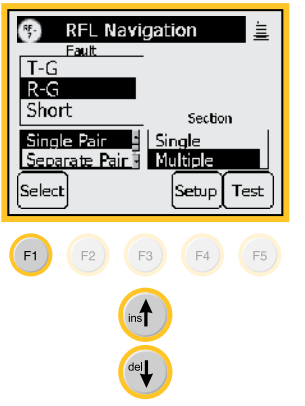
   Tip Cross, Ring Cross, Wet Pulp, T-G, R-G, Short

   This example will show a Ring-Ground fault.

   Press **Select** to move to the Pair section.

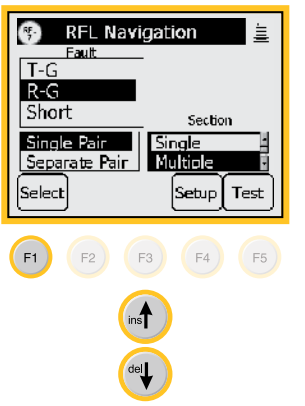
3. Use the up and down arrow keys to select Single Pair.

   Press **Select** to move to the Multiple-Single section.



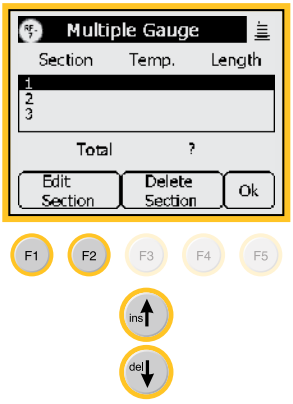
4. Use the up and down arrow keys to select Multiple sections of cable that have more that one gauge.

5. Press **Setup** to choose the measurement parameters.



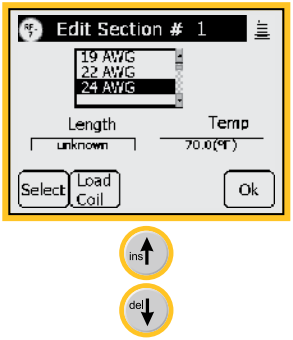
RFL>**Single Pair, Multi-Section Operation**

6. Use the up and down arrow keys to select a section. Press **Edit Section** to choose the measurement parameters.



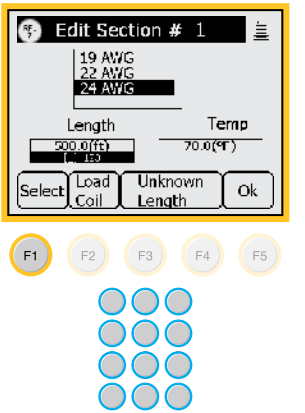
7. The first parameter is the gauge. Use the Up and Down arrow keys to highlight the gauge of your cable.

   Press **Select** to highlight the section length section.



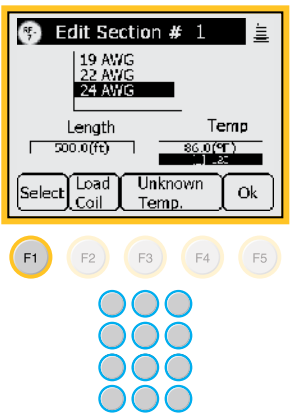
8. Use the blue keys to enter the section length.

   Press **Select** to move to the Temp section.



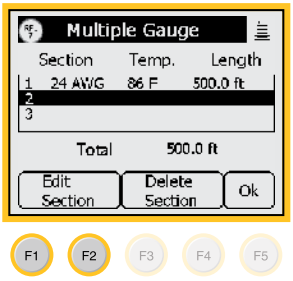
9. Use the blue keys to enter the cable temperature.

   Press **OK** to return to the Multiple Gauge screen.

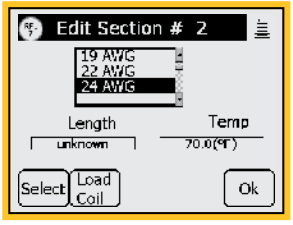


RFL>**Single Pair, Multi-Section Operation**

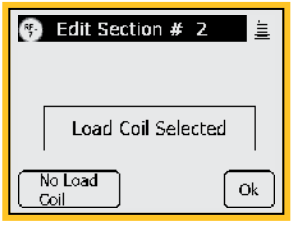
10. Use the up and down arrow keys to select the next section. Press **Edit Section** to choose the measurement parameters.



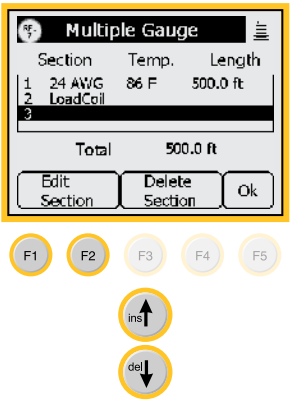
11. You can add a load coil to the calculations. Press **Load Coil** to add the load coil to the section. You can add as many load coils as you need, but each one must be in a different section on the screen.



12. Press **OK** to store the load coil and return to the Multiple Gauge screen.

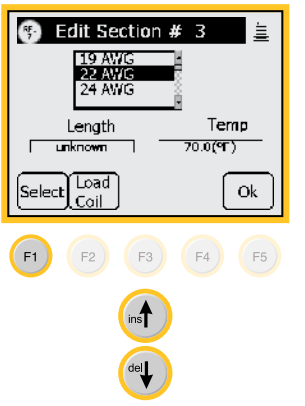


13. Use the up and down arrow keys to select the next section. Press **Edit Section** to choose the measurement parameters.



14. Use the Up and Down arrow keys to highlight the gauge of your cable.

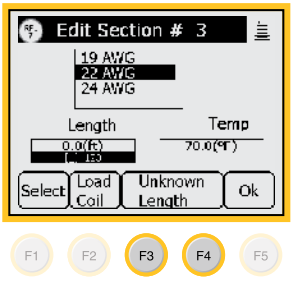
    Press **Select** to highlight the section length section.



RFL>**Single Pair, Multi-Section Operation**

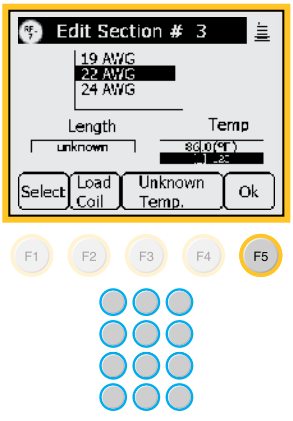
Special Requirement: Enter the cable temperature or the length, but not both. Only one parameter can be entered. There must be one unknown to solve the calculation.

For this example, we will use the cable temperature as the known value and the length will not be entered.

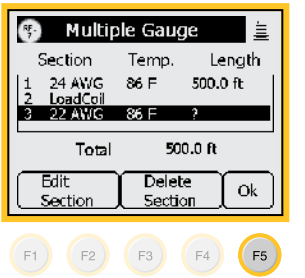


15. Press **Unknown Length** to enter an unknown length and move to the Temp section.
16. Use the blue keys to enter the cable temperature.

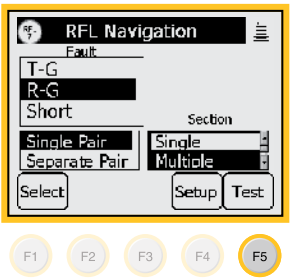
    Press **OK** to return to the Multiple Gauge screen.



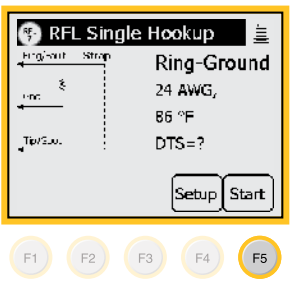
17. Press [OK] again to return to the main RFL screen.



18. Press [Test] to review the settings.

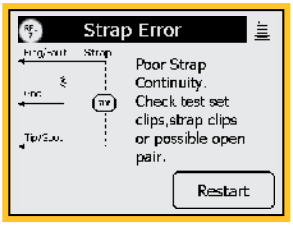


19. This screen shows the test lead hook-ups and the settings you have selected. Press [Start] to begin the test.

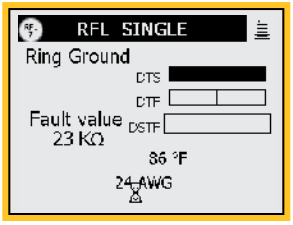


RFL>**Single Pair, Multi-Section Operation**

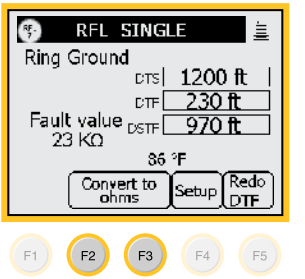
20. If the hook-up is not correct, you will see an error message on the wiring diagram at the point of the error.



21. During the measurement process, a bar graph of the null voltage for DTS and then for DTF will be visible on the screen.



22. The results of the measurements are displayed on the screen.



DTS is the distance to the strap.

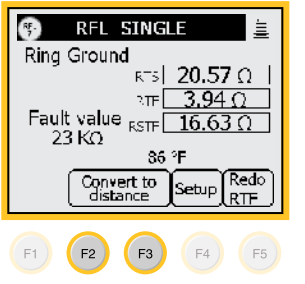
DTF is the distance to the fault.

DSTF is the distance from the strap to the fault.

This screen also displays the value of the fault.

In some situations it may be more helpful to use the resistance values instead of the distance values. Press **Convert to ohms** to use the resistance values.

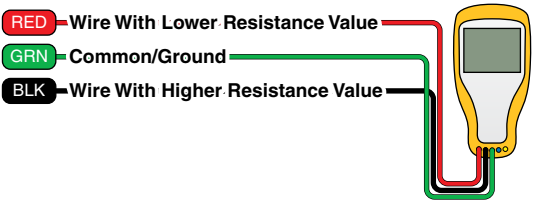
23. Press **Convert to distance** to convert the resistance back to distance.



RFL>**Wet Pulp**

Use this function to find the approximate distance to a resistance fault when both wires in a pair are faulted at the same place and a separate good pair or a single common conductor is not available.

RFL>Wet Pulp>**Hook-Up**



1. The resistance faults must be common to the reference (Green) conductor. Use the ohmmeter function to measure the resistance on each side of the pair to the reference conductor.
2. The lower value fault should be connected to the Red test lead.
3. The higher value fault should be connected to the Black test lead.
4. The Green test lead should be connected to the reference conductor, usually the shield or ground.

RFL>Wet Pulp> **Requirements**

Note: All of the following conditions must be met or this function does not apply:

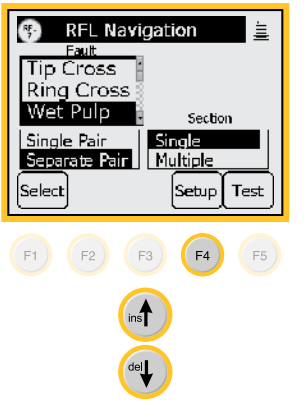
1. One fault must be at least twice the ohms value of the other fault. For example, a 5 kΩfault has twice the value of a 10 kΩfault.
2. The sum of both faults must be at least 100 times the loop resistance of the pair. For example, if the loop resistance is 50 Ω, the sum of the faults must be 5 kΩor greater. You may continue with the test, but the results may have a reduced accuracy.
3. The 965AMS checks to see if the resistance of the loop is less than 7 kΩ. If the resistance is greater than 7 kΩ, the distance to strap may be too long or the strap is not connected,

RFL>Wet Pulp>**Operation**

1. Press the blue RFL 7pqrs / 7pqrs key to enter the RFL function.

   Use the up and down keys to select Wet Pulp.

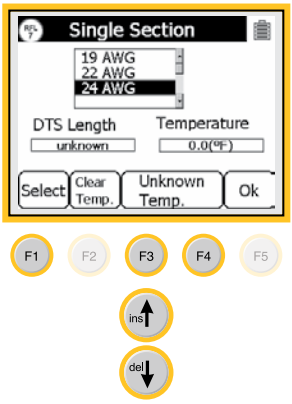
   Press Setup to select the gauge of the pair.



RFL>Wet Pulp>**Operation**

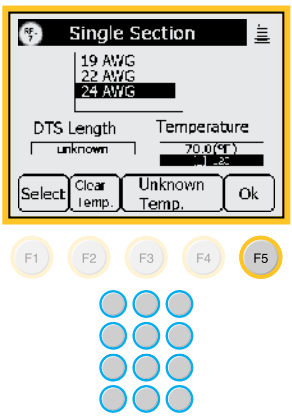
2. Use the up and down arrow keys to select the gauge of the pair.

   Press **Select** or **Unknown Temp.** to highlight the temperature field.



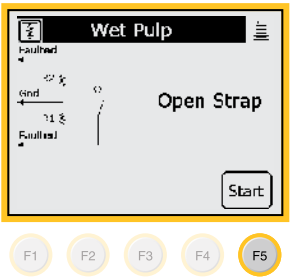
3. Use the blue keypad to enter the cable temperature.

   Press **OK** to continue.



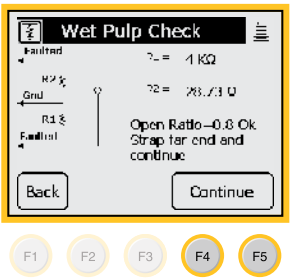
4. The Wet Pulp test first makes a measurement with the far-end open.

   Press **Start** to start the test.



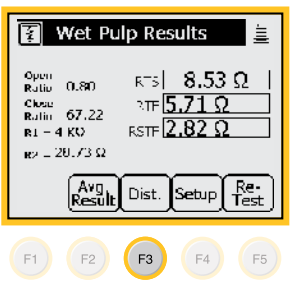
5. Strap the pair at the far end, then press **Continue**.

Note: The "Opens Ratio" value displayed on the screen is the ratio of R1/(R2+R1) times 100. This value is used by some companies as part of the measurement. It is not needed to calculate the distance to the fault.



6. The test results are shown in ohms.

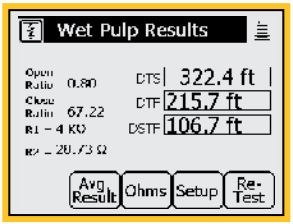
   Press **Dist.** to convert the ohms to the distance to the fault.



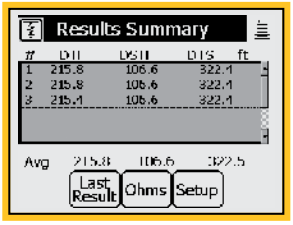
RFL>Wet Pulp>**Operation**

7. DTS—Distance to the strap (far end).
   DTF—Distance to the fault.
   DSTF—Distance from the strap to the fault.

   Press **Avg. Result** to view a summary of test results.

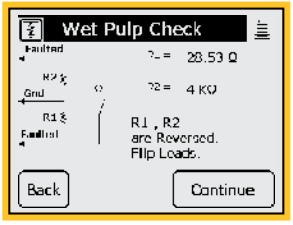


8. Use the results of this test to find the distance or run the test multiple times and the tester will average the distances.

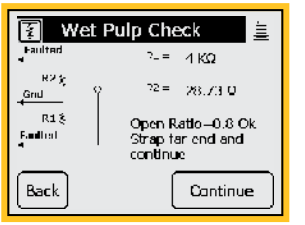


RFL>Wet Pulp>**Error Screens**

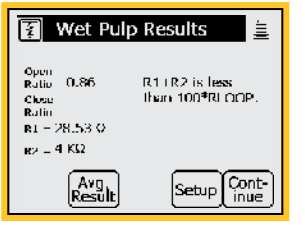
1. Swap the Red and Black test leads.



2. The strap at the far-end is open. There should be a solid short at the far-end.



3. The tester checks to see that the sum of the faults is more than 100 times the loop resistance. You may press **Continue** with the test, but the results may have a reduced accuracy.



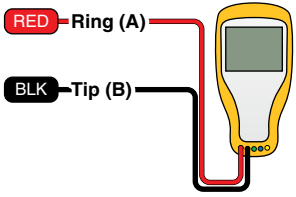
DSL (Digital Subscriber Line)

The **DSL** (DSL 8 tuv) functions include: DSL Loss, DSL Noise, DSL Spectrum Analyzer, Resistive Balance, and DSL Impulse Noise.

DSL>**DSL Loss**

Use **DSL Loss** function to measure the amount of loss in a circuit at a specific frequency. This is typically accomplished by sending tone with another 965AMS tester, a 3M™ Dynatel™ Far End Device (FED), or test equipment that is capable of sending wideband tone from 20 kHz to 30 MHz.

DSL>DSL Loss>**Hook-Up**

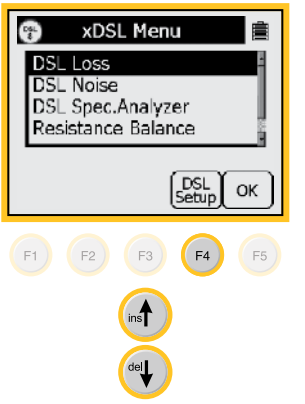


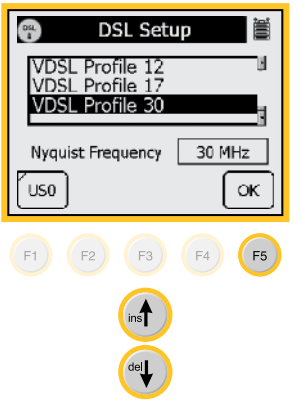
1. Press the blue DSL key to enter the DSL function.

   Use the up and down arrow keys to select DSL Loss.

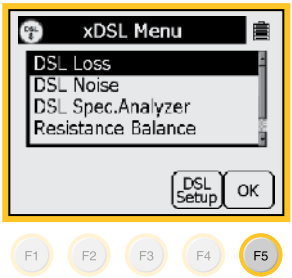
   Use a tone source at the far end that is capable of sending a known output level such as a 965AMS tester. Use 0dBm as the output level or follow your method of test.

2. Press **DSL Setup** to select the type of service.
3. Use the up and down arrow keys to select the type of service that you are measuring.
4. Press **OK** when finished.

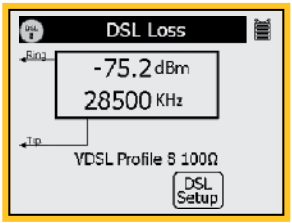




5. Press OK to make the measurement.



6. The results of the measurement will be displayed as a –dBm level at a specific frequency.



DSL Loss measures the signal lost from a tone transmitter (965AMS tester, 3M™ Dynatel™ Far End Device (FED) or other capable device) to the measuring 965AMS.

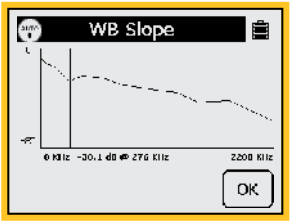
High loss is an indication of:

1. A loop that is too long for the potential service.

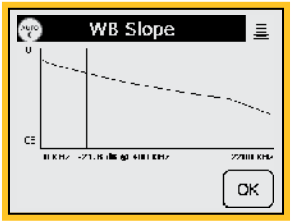
2. Bridge tap.

To get a complete picture of loss, it is recommended that you use a FED device that will generate a sweep of frequency for the service type. The sweep will indicate either a good circuit, high loss or dips in the reading can be an indication of bridge tap. The image below is a sweep that was performed with a 965AMS tester, a 3M™ Dynatel™ Far End Device FED II and the selected service was ADSL2.

Look at the before and after for these two readings. When the bridge tap is removed then the slope no longer displays frequency dips.



With 500 feet of bridge tap

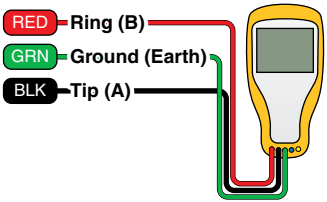


With bridge tap removed

DSL>**DSL Noise**

Use **DSL Noise** function to measure the Longitudinal or Metallic Noise on a DSL line.

DSL>DSL Noise>**Hook-Up**

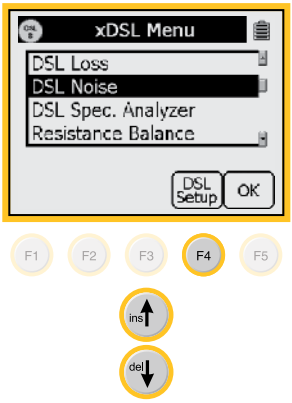


DSL>DSL Noise>**Operation**

1. Press the blue DSL key to enter the DSL function.

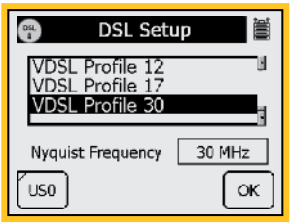
   Use the up and down arrow keys to select DSL Noise.

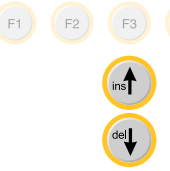
2. Press **DSL Setup** to select the type of service.



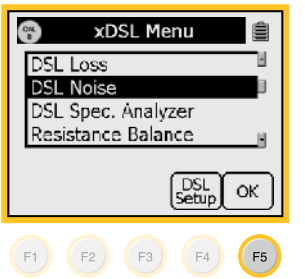
3. Use the up and down arrow keys to select the type of service that you are measuring.

4. Press OK when finished.

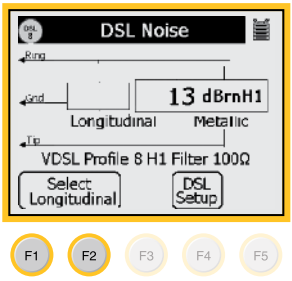




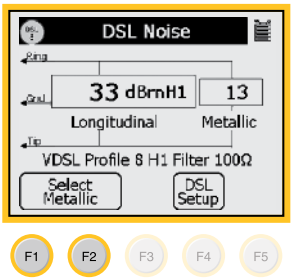
5. Press OK to start the measurement for DSL noise.



6. Press **Select Longitudinal** to measure longitudinal noise.



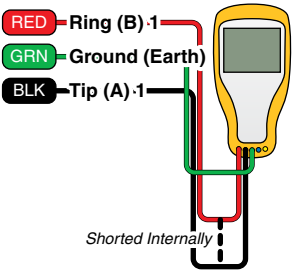
7. Press **Select Metallic** to measure metallic noise.



Noise can affect wideband services by taking up valuable bandwidth and reducing speed. Symptoms of high noise can be data errors and loss of connection. The 965AMS tester measures longitudinal as well as metallic noise. Having high noise in either of these tests will prompt you to look at the circuit with a Spectrum Analyzer to identify the source.

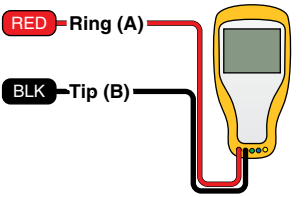
Longitudinal Noise is a measured between Tip [A] and Ring [B] (shorted internally) and the shield/ground.

Longitudinal Noise measures influences from outside the cable (power induction, AM radio or other outside frequencies).



Metallic Noise is a measured between Tip [A] and Ring [B].

Metallic Noise measures the active noise on a pair.

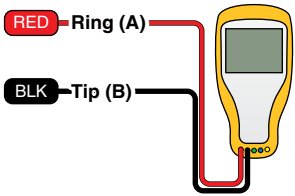


Both tests are performed through filters based on the service that is selected in Setup.

DSL>**DSL Spectrum Analyzer**

Use **DSL Spectrum Analyzer** (SA) to display a graph of useful signals and interference/noise at specific frequencies up to 30 MHz.

DSL>DSL Spectrum Analyzer>**Hook-Up**

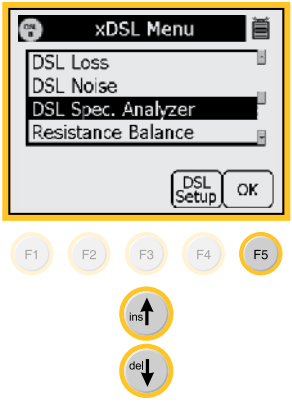


DSL>DSL Spectrum Analyzer>**Operation**

1. Press the blue DSL (8 tuv) key to enter the DSL function.

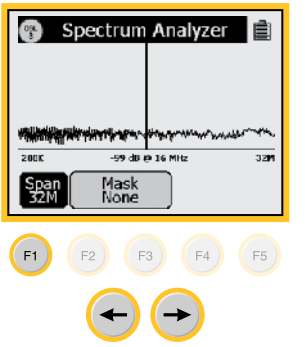
   Use the up and down arrow keys to select DSL Spec. Analyzer.

2. Press [OK].



3. Press **Span** to change the frequency range.

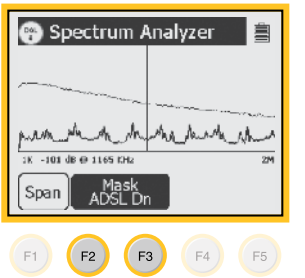
4. Use the left and right arrow keys to move the cursor. The cursor position will display the frequency and the signal level.



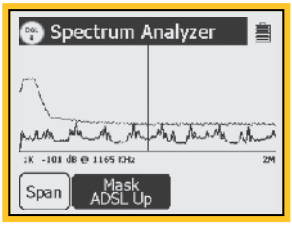
5. Once you have selected a span of 1M or 2M you may add a noise mask.

   The mask is initially set to “none.” Pressing F2 or F3, the screen will show the following masks:

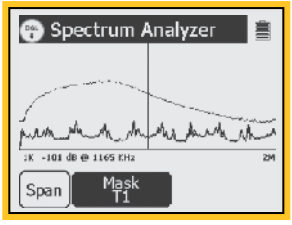
   ADSL Downstream



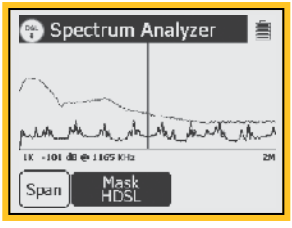
ADSL Upstream



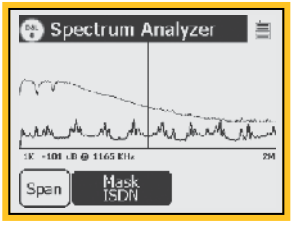
T1



HDSL



ISDN

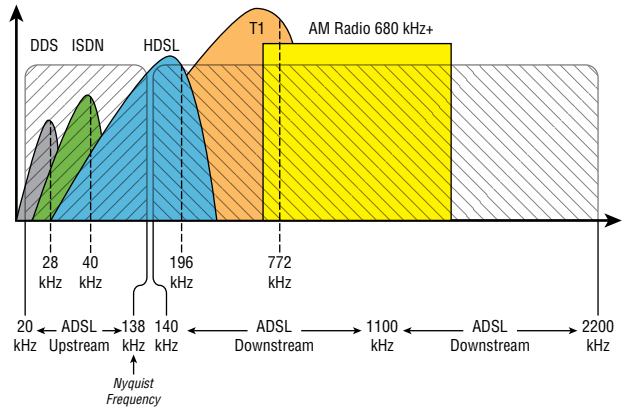


Spectrum analysis allows you to visually see a disturbing signal's shape by reading and displaying the level of noise in a frequency range.

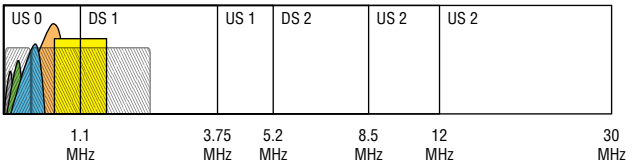
The shape can be caused by ADSL, ISDN, HDSL, T1 or VDSL.

This chart shows the ADSL2+ spectrum with common disturbers and chart 2 shows the VDSL spectrum with potential disturbers.

Center Frequencies



VDSL Spectrum

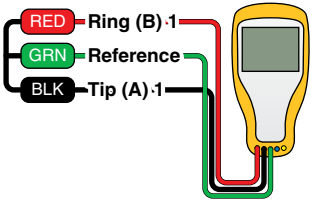


DSL>**Resistance Balance**

Use **Resistance Balance** to measure the:

- Loop Resistance between the Red and Black test leads.
- Resistance of each conductor to the Green test lead.
- Resistance Difference between the two conductors.
- Percentage of Resistance Difference.

DSL>Resistance Balance>**Hook-Up**

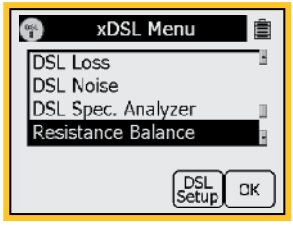


DSL>Resistance Balance>**Operation**

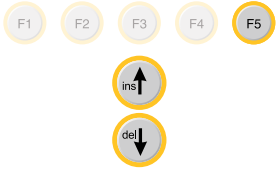
1. Press the blue DSL key to enter the DSL function.

   Use the up and down arrow keys to select Resistance Balance.

   Press OK.

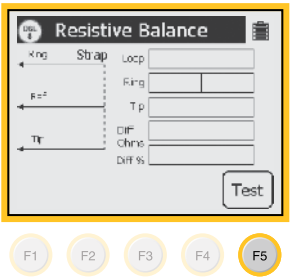


2. Connect the strap at a 'far-end' access point. The strap should be connected to all three of the conductors at the far end.



*DSL>Resistance Balance>**Operation***

3. Press Test to start the test.



*DSL>Resistance Balance>**Recommended Values***

Service	% Ohms Difference
POTS	3%
Wideband	1%

Parameter	OK	Marginal	Not OK
Resistance Balance	<1%	1%–5%	>5%

*DSL>Resistance Balance>**Application Notes***

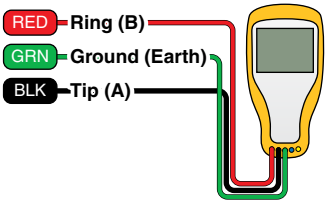
The resistance balance test is used to identify a high resistance open or a bad splice.

The test will also identify a loop that is resistively too long for the selected autotest.

DSL>**DSL Impulse Noise**

Use Impulse Noise to measure short spikes of random amplitude and random frequency. These short bursts can damage data transmission if the amplitude and frequency are spiking into used transmission paths. The 965AMS tester measures spikes eight times per second.

DSL>DSL Impulse Noise>**Hook-Up**

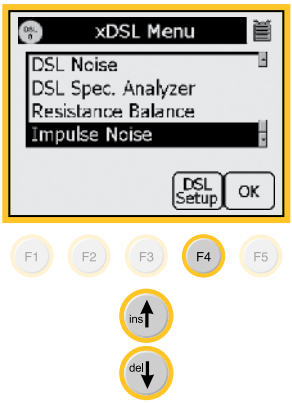


DSL>DSL Impulse Noise>**Operation**

1. Press the blue DSL key to enter the DSL function.

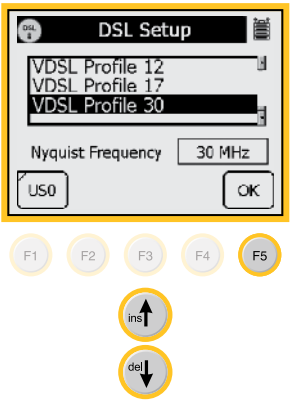
   Use the up and down arrow keys to select Impulse Noise.

2. Press DSL Setup to select the type of service.

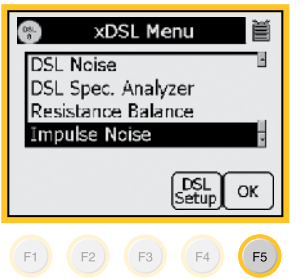


3. Use the up and down arrow keys to select the type of service that you are measuring.

4. Press OK when finished.



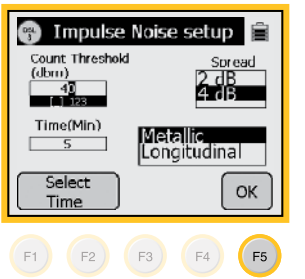
5. Press OK to start the Impulse Noise test.



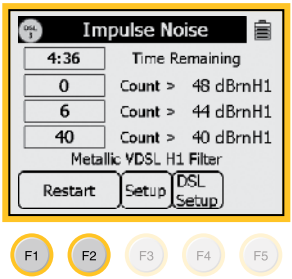
6. Press Setup to select:

   Count Threshold
   Time
   Spread
   Metallic or Longitudinal

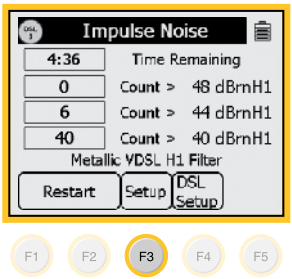
7. Press OK when finished.



8. Press **Restart** to begin a new test.

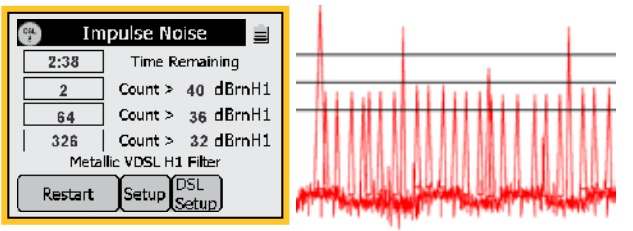


9. Press **Setup** to return to the setup screen.



Since impulse hits, noise and other power related interference can fluctuate during the day you have the option of measuring three different levels. If you traditionally measure Impulse hits at a threshold of 40 dBrn, then select a count threshold of 32 and a spread of 2 dB, then you will be able to see any hits that exceed 32, 36 or 40. Although this circuit will pass at 40, you will be able to see if there is noise just under the threshold that can appear later with a change in power usage or plant conditions.

Selected a spread of 4 dB and a threshold of 32 would allow you to count hits that exceed 32, 36 and 40.



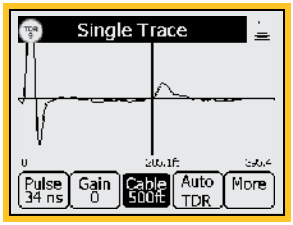
Check with your DSLAM vendor regarding excessive hits for a circuit. Different DLSAM vendors have settings to make use of buffers (dynamic memory) to compensate for errors that can be caused by impulse noise.

TDR

Use the **Time Domain Reflectometer (TDR)** function to map the high-frequency impedance of the cable along its length. The display shows opens, load coils, splits, wet sections, splices, gauge changes, heavy shorts and any other physical deviation from a perfect cable. Each of these events have their own unique signature. A user-controlled vertical cursor is used to measure the distance to an event.

TDR>Event Recognition

"Events" are the "dips" and "peaks" seen on the screen caused by faults or changes in the pair.



"Peak" Events

1. **Launch Pulse:** The first peak on the screen is the "launch pulse" which occurs where the transition from the tester to the test leads occurs.

2. **Open:** A clean or partial open will show up as a peak on the screen. The "cleaner" the open, the taller the peak. A complete open will be the tallest peak (other than the launch pulse).You can not see events past a complete open.

3. **Load Coil:** A load coil looks very similar to an open. If you think there is a load coil on the pair, use the Load Coil function (in the POTS test) to verify its presence. You can not see events past a traditional load coil.

"Dip" Events

1. **Fault:** A resistance fault will show as a dip on screen. The lower the value of resistance, the lower the dip.
2. **Short:** A short (or zero-Ohm resistance fault) will show up as the lowest dip on the screen. You cannot see events past a short.
3. **BridgeTap:** A bridge tap will look like a small dip where the bridge tap begins. The end of the bridge tap looks like an upward event. The distance between the two events is the length of the bridge tap. The start of a bridge tap looks like a resistance fault. Use the ohms measurement function to measure the resistance on the pair. If there is no resistance, and you see a dip followed by a peak, you might suspect a bridge tap.

Fault Icons

Faults are represented on the screen with icons:


Load Coil


Open


Short

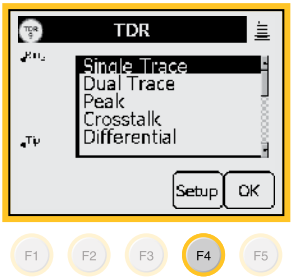

Bridge Tap


Event Found

TDR>**Setup**

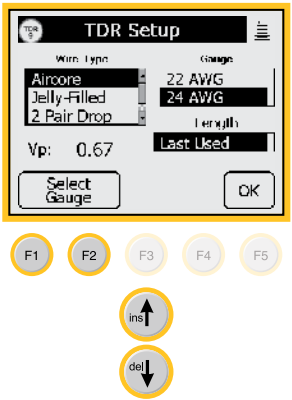
1. Press the blue TDR 9 wxyz key to enter the TDR mode.

2. Press **Setup**.



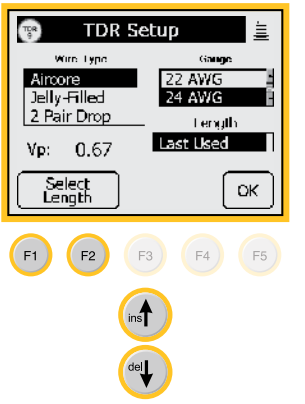
3. Use the up and down arrow keys to select the type of cable.

   Press **Select Gauge**.



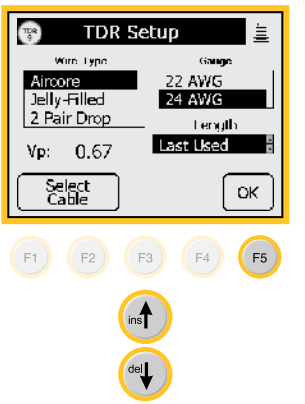
4. Use the up and down arrow keys to select the wire gauge.

   Press **Select Length**.



5. You can choose to start with the shortest range each time you enter the TDR or the last range that you used. Use the up and down arrow keys to select Minimum or Last Used range.

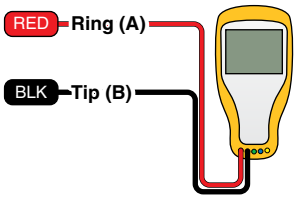
6. Press **OK** to return to the TDR menu screen.



TDR>**Single Trace Mode**

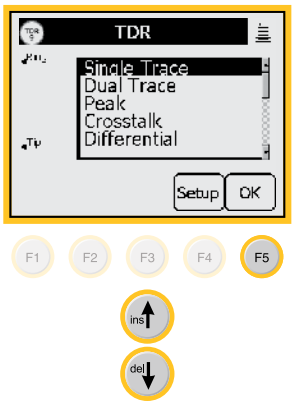
Single Trace Mode is used for most TDR applications. You can use the single trace manual mode or you can use the Auto TDR mode.

TDR>Single Trace Mode>**Hook-Up**

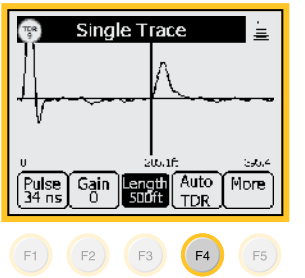


TDR>Single Trace Mode>**Operation**

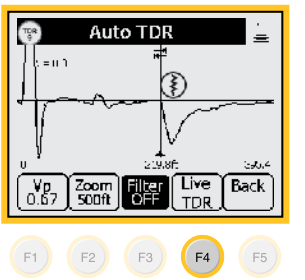
1. Press the blue TDR 9 wxyz key to enter the TDR mode. Use the up and down arrow keys to select Single Trace.
2. Press OK to display a trace.



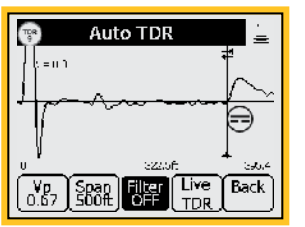
3. This screen shows the end of a pair at 205 feet.



4. Use the TDR Controls section in this chapter to see all of the parameters that you can adjust.
5. The Auto TDR mode automatically finds potential faults and displays an icon that represents the type of fault. Press **Auto TDR** to use this function.
6. This trace shows a resistive fault at 219 feet.



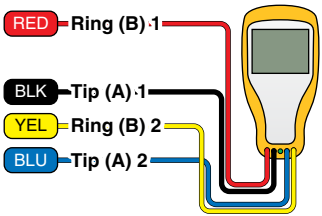
7. The Auto TDR is not a live trace, but you can use the Gain, Cable length, Span and Filter functions.
8. If you change the circuit you must capture a new trace. Press **Live TDR** then press **Auto TDR**.
9. This trace shows an open at 322 feet.



TDR>**Dual Trace Mode**

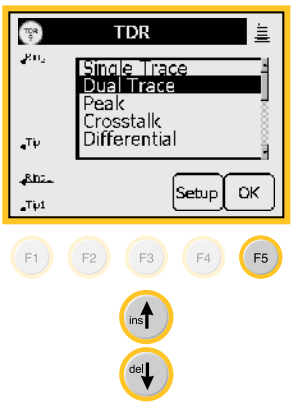
Dual Trace Mode is used to compare two pairs at the same time, usually a faulted and a good pair.

TDR>Dual Trace Mode>**Hook-Up**



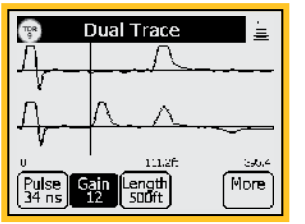
TDR>Dual Trace Mode>**Operation**

1. Press the blue TDR 9 wxyz key to enter the TDR mode. Use the up and down arrow keys to select Dual Trace.
2. Press OK to display a trace.



*TDR>Dual Trace Mode>**Operation***

3. The pair under test (red/black) is displayed at the top of the screen. The reference pair (yellow/blue) is displayed at the bottom of the screen.

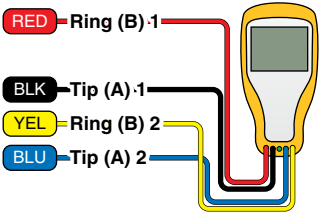


4. Any changes in the control parameters affect both traces. It is not possible to control each trace independently.

*TDR>**Differential***

Use the **Differential** mode to display only the differences between two pairs, usually a ‘good’ pair and a pair under test.

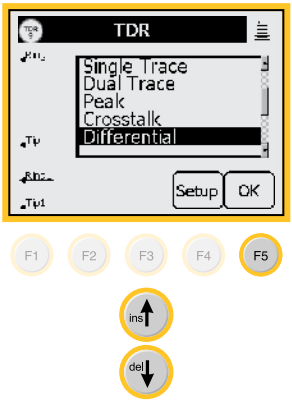
*TDR>Differential>**Hook-Up***



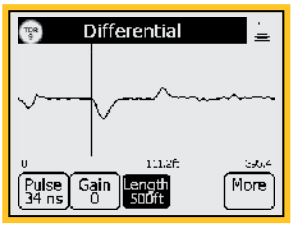
1. Connect the red and black test leads to the pair under test.
2. Connect the blue and yellow test leads to a known good pair in the same cable. This is called the reference pair.

TDR>Differential>**Operation**

1. Press the blue TDR 9 wxyz / 9 wxyz key to enter the TDR mode. Use the up and down arrow keys to select Differential.
2. Press OK to display a trace.



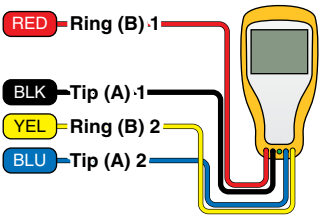
3. A trace with a straight line would indicate a perfect match between both pairs. This trace shows differences between the reference pair (blue/yellow) and the pair under test (red/black).



TDR>**Crosstalk**

Use **Crosstalk** to display the amplitude and location of signals that "cross" from one pair to the other, as could be caused by a split.

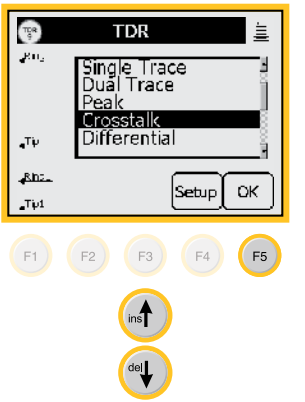
TDR>Crosstalk>**Hook-Up**



1. Connect the red and black test leads to the pair under test.
2. Connect the blue and yellow test leads to a pair that is suspected of having a crosstalk problem.

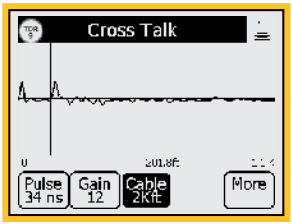
TDR>Crosstalk>**Operation**

1. Press the blue key to enter the TDR mode. Use the up and down arrow keys to select Crosstalk.
2. Press OK to display a trace.



TDR>Crosstalk>**Operation**

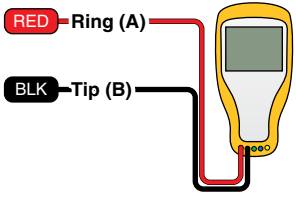
3. The location of the crosstalk will be shown as an upward or downward event.



TDR>**Memory Mode**

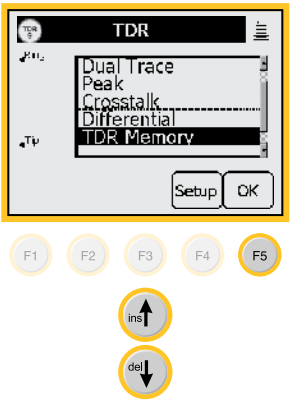
Memory Mode is used to compare a pair under test to a stored trace in memory.

TDR>Memory Mode>**Hook-Up**

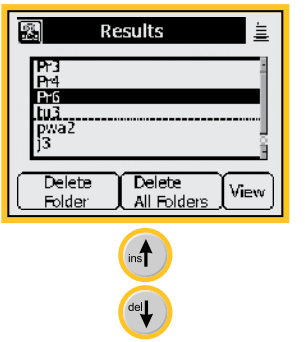


1. Press the blue TDR 9 wxyz / 9 wxyz key to enter the TDR mode. Use the up and down arrow keys to select Memory.

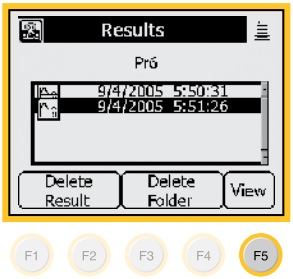
2. Press OK.



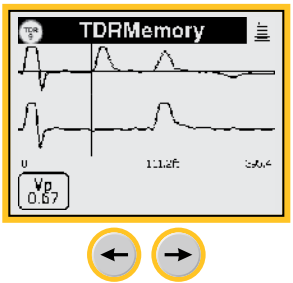
2. The first screen in memory mode will show a list of the ID numbers for all stored Single Trace TDR traces. Use the up and down arrows keys to highlight the desired stored result.



3. Press the View key to select the highlighted result and display the stored results list for that ID number by type (TDR), date, and time.



4. The stored trace is displayed on the bottom of the TDR Memory screen and the “live” trace on the top. Move the cursor using the left and right arrow keys.

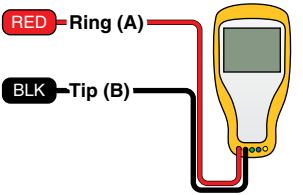


5. The TDR Memory screen defaults to the control settings that were active when the stored trace was saved using the “TDR Save” function.

TDR>**Peak Mode**

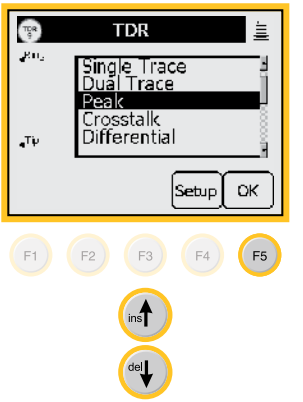
Use **Peak Mode** to capture events that may be intermittent.

TDR>Peak Mode>**Hook-Up**

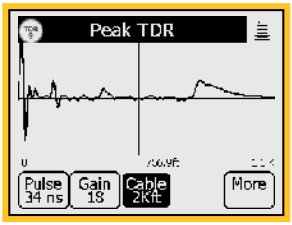


TDR>Peak Mode>**Operation**

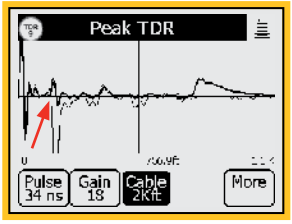
1. Press the blue TDR key to enter the TDR mode. Use the up and down arrow keys to select Peak.
2. Press OK to display a trace.
3. The 'live' trace is displayed continuously as a normal line. As a new maximum or minimum trace is detected, it will be displayed as a thin line along with the live trace.



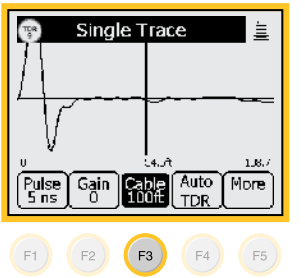
4. If the pair being tested is stable (no intermittent faults), then the minimum, maximum and 'live' traces should appear as a single line.



5. If any of the control values are changed, the peak histories will be erased and new values will begin to display.
6. The trace with the thin line (red arrow) shows where the intermittent starts. The end of the thin line does not provide any useful information.



Cable Length



1. The Length allows you to set the distance from the left side of the screen to the right side.

   The lengths that you may use are:

   100 ft
   200 ft
   500 ft
   1,000 ft
   2,000 ft
   5,000 ft
   10,000 ft
   20, 000 ft
   30,000 ft

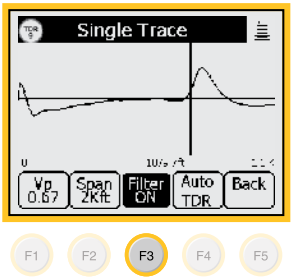
2. The left side of the screen is usually at the test set and the right side is the furthest distance that can be displayed with the length selected.

Screen Pan

1. The start and stop numbers shown in the distance bar are the distances represented at the left and right side of the screen.
2. If you move the cursor to the right side of the screen, the screen will “pan” to the right.
3. If you move the cursor to the left side of the screen the screen will “pan” to the left until it reaches Zero.

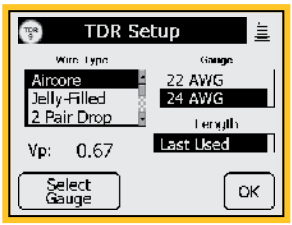
Filter

1. The Filter is used to reduce external noise from the trace.

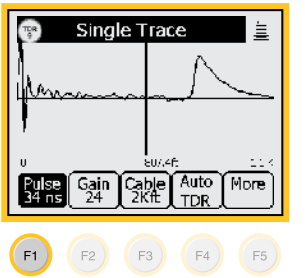


Velocity of Propagation

1. The velocity of propagation is a measure of how fast a pulse travels in a circuit.
2. To get the most accurate distance measurement the VP should be set to the value for the cable type and gauge you are testing.
3. If you do not know the VP, we recommend you use the TDR Setup menu. In this menu, you will select the type of wire you are testing and the tester will choose the VP.

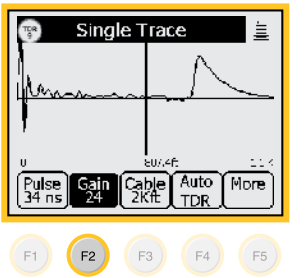


Pulse Width



1. Pulse Width allows you to select the width of the TDR pulse. A longer pulse width is required for longer range settings.
2. The tester automatically chooses the best pulse width for each length selected.
3. You can change the pulse width independent of the length, but we recommend you let the tester select the pulse width.

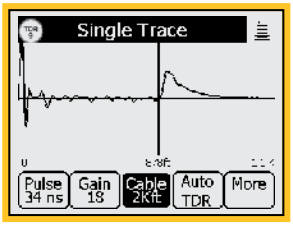
Gain



1. The Gain control allows you to increase the height and depth of events.
2. Higher gain will make events look taller or deeper on the screen which may be helpful in finding small events.

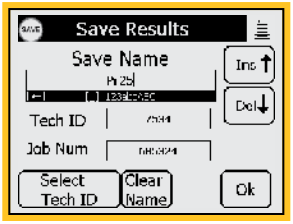
TDR Save

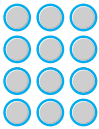
1. Traces can be stored in the single trace mode. None of the other TDR modes can be saved. Up to two-hundred traces can be stored.



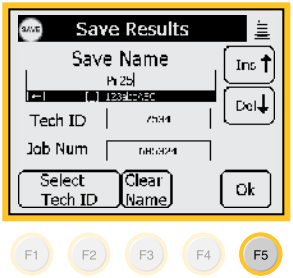
2. Press the SAVE key to enter the Save mode.

   Use the blue keys to enter an alphanumeric ID. Enter the numbers and letters like you would with your cell phone memory. This could be a single number such as “8” or a label such as “cable-23-pr-12”. You may have up to 20 characters in the label. Upper and lower case letters are supported.





3. Press OK to save the file.



4. The data entered into each field will remain present for every saved result until explicitly changed or cleared. In this way information that is infrequently changed such as the Tech ID does not need to be re-keyed every time. These two fields are appended to the TDR trace results when they are printed or stored in the PC Link software.

POTS

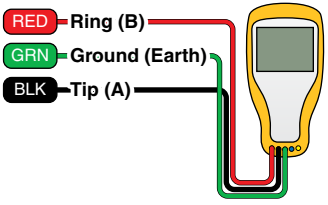
Tests available with the **POTS** key include Loss, Noise, Longitudinal Balance, Load Coil Counter, Caller ID, Ringers, Level Trace, Kick Test and Voice Band Spectrum Analyzer.

POTS>**Loss**

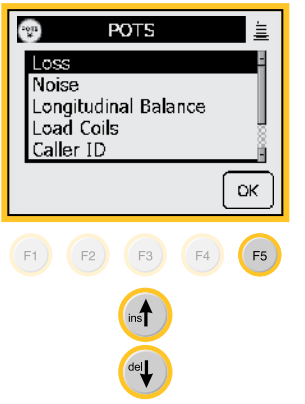
Use **Loss** to measure the loss from the far-end of a circuit to the near-end using a precision tone between 200 Hz and 20kHz.

Note: You must use a device at the far end to generate the tone. This could be the milliwatt number in the central office or a 965AMS set to the tone mode.

POTS>Loss>**Hook-Up**



1. Press the blue POTS key to enter POTS menu. Use the up and down arrow keys to select Loss.
2. Press OK to start the test.

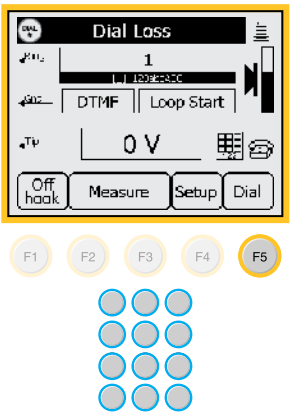


3. Dial a milliwatt number.

   There are 2 ways to enter the milliwatt numbers:

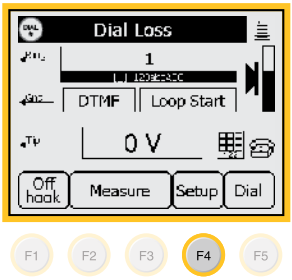
   1. **Use the blue keys to enter the number just like you were dialing a standard telephone.**

      Press Dial when you have entered all of the digits.



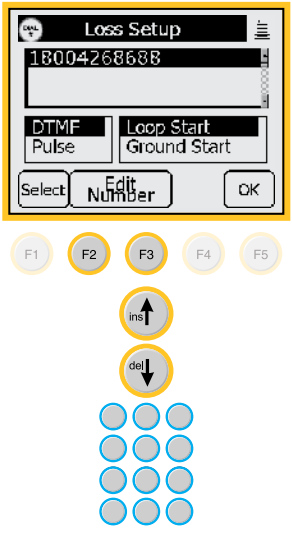
2. **Or, use the memory mode.** The 965AMS can store up to 10 numbers in the quiet line memory list.

   Press **Setup** to select or edit numbers from memory.

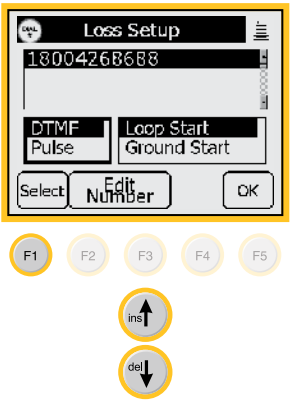


   a. Use the up and down arrow keys to find the quiet line number for the central office you want to measure.

   b. Use **Edit Number** to add new numbers or to edit existing numbers using the blue keys.

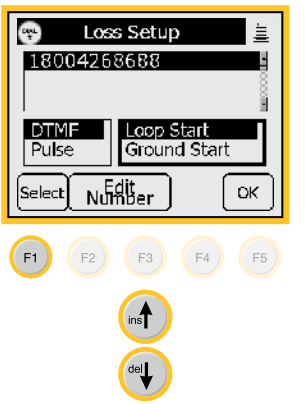


c. Press **Select** to move to the DTMF or Pulse dialing section. Use the up and down arrow keys to select a dialing method. DTMF pulsing is the default value.

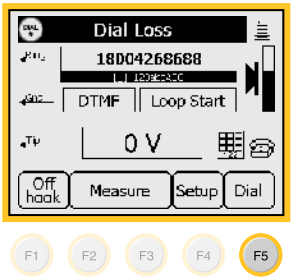


d. Press **Select** to move to the loop start-ground start section. Use the up and down arrow keys to select a method. The default is loop start.

Press **OK** to return to the main Dial Loss screen.



e. Press Dial to begin the test.



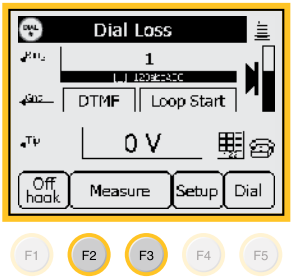
4. Point to Point Measurements

   a. Use a 965AMS tester or a 965DSP tester set to the tone mode.

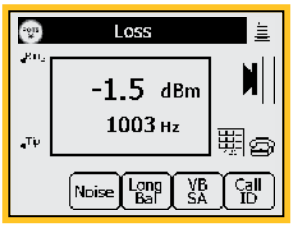
   b. Verify that both ends of the circuit are on the same frequency.

   c. Press Send Tone at the sending end.

   d. Press Measure at the receiving end.



5. Results screen:



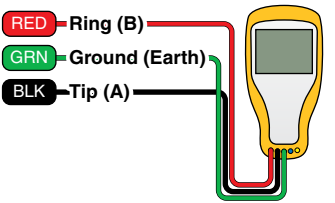
POTS Loss Measurement Normal Range

Parameter	OK	Marginal	Not OK
Balance	> 60	50–60	< 50 dB
Loss	< 6	6–8.5	> 8.5 dBm
Noise	< 20	20–30	> 30 dBmC

POTS>**Noise**

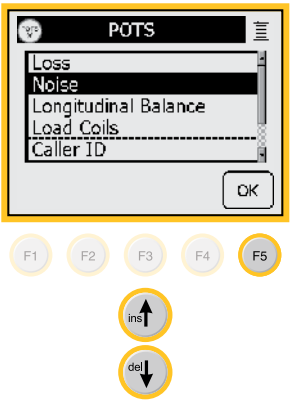
Use **Noise** to measure the Noise, Power Influence, and the calculated Balance of a pair.

POTS>Noise>**Hook-Up**



POTS>Noise>**Operation**

1. Press the blue POTS key to enter POTS menu. Use the up and down arrow keys to select Noise.
2. Press OK to start the test.



3. Enter the quiet line number for the central office you are calling.

   There are 2 ways to enter the quiet line numbers:

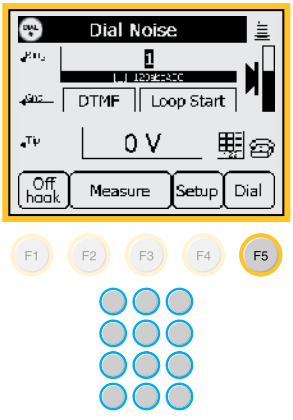
   1. **Use the blue keys to enter the number just like you were dialing a standard telephone.**

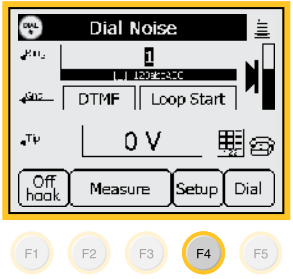
      If you have a combination milliwatt and quiet line, enter the number 3 as the telephone number. This will provide the proper termination for the noise measurement.

      Press [Dial] when you have entered all of the digits.

   2. **Or, use the memory mode.** Up to 10 numbers can be stored in the quiet line memory list.

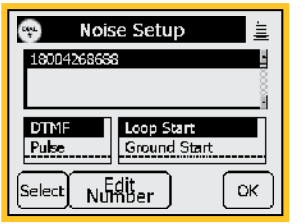
      Press [Setup] to select or edit numbers from memory.

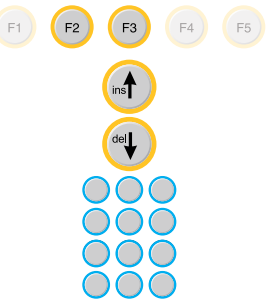




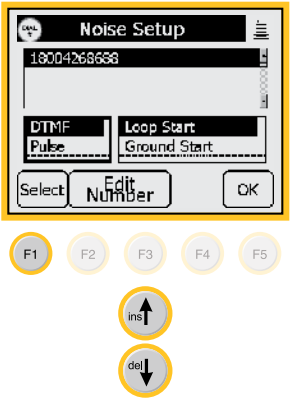
a. Use the up and down arrow keys to find the quiet line number for the central office you want to measure.

b. Use **Edit Number** to add new numbers or to edit existing numbers using the blue keys.

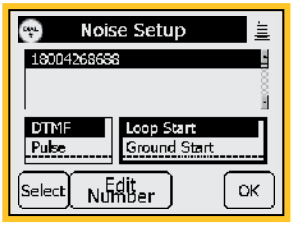




c. Press **Select** to move to the DTMF or Pulse dialing section. Use the up and down arrow keys to select a dialing method. DTMF pulsing is the default value.

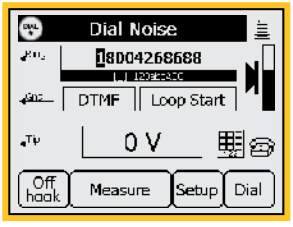


d. Press **Select** to move to the loop start-ground start section. Use the up and down arrow keys to select a method. The default is loop start.

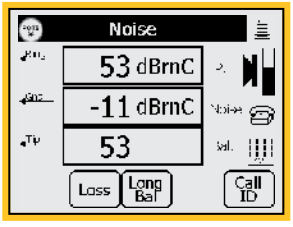


Press **OK** to return to the main Dial Noise screen.

e. Press **Dial** to begin the test.



4. Results screen:



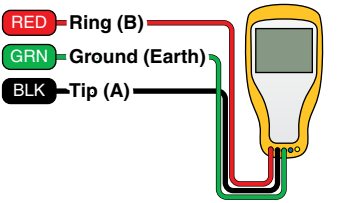
POTS Noise Normal Range

Parameter	OK	Marginal	Not OK
Balance	> 60	50–60	< 50 dBm
Loss	< 6	6–8.5	> 8.5 dBm
Noise	< 20	20–30	> 30 dBmC

POTS>**Longitudinal Balance**

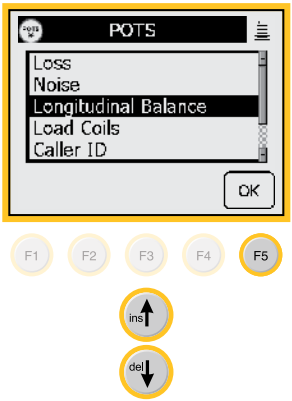
Use **Longitudinal Balance** to measure the active Longitudinal Balance on the pair. This test measures the ability of the Tip and Ring to reject noise and crosstalk.

POTS>Longitudinal Balance>**Hook-Up**



1. Press the blue POTS key to enter the POTS menu. Use the up and down arrow keys to select Longitudinal Balance.

2. Press OK to start the measurement.

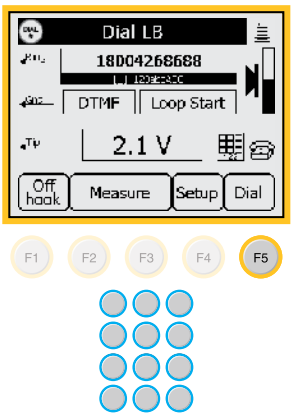


3. Dial a quiet line number.

   There are 2 ways to enter the quiet line numbers:

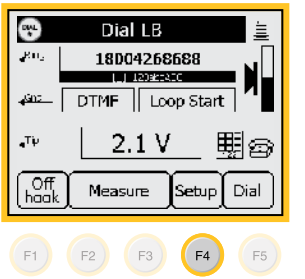
   1. **Use the blue keys to enter the number just like you were dialing a standard telephone.**

      Press Dial when you have entered all of the digits.



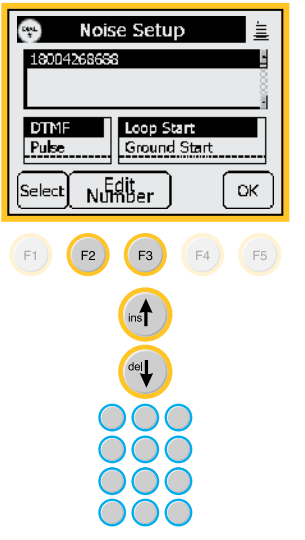
2. **Or, use the memory mode.** The 965AMS can store up to 10 numbers in the milliwatt number memory list.

   Press **Setup** to select or edit numbers from memory.

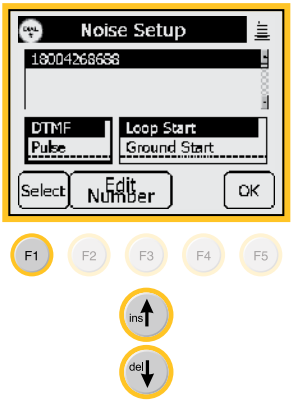


   a. Use the up and down arrow keys to find the quiet line number for the central office you want to measure.

   b. Use **Edit Number** to add new numbers or to edit existing numbers using the blue keys.

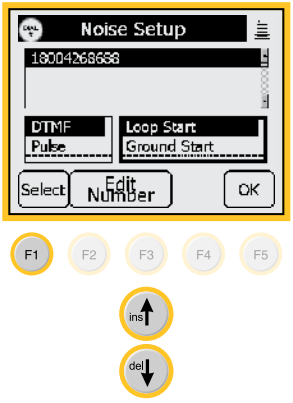


c. Press **Select** to move to the DTMF or Pulse dialing section. Use the up and down arrow keys to select a dialing method. DTMF pulsing is the default value.

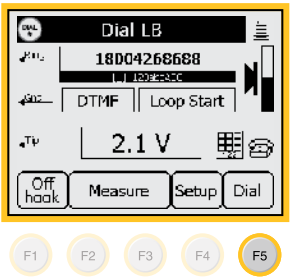


d. Press **Select** to move to the loop start-ground start section. Use the up and down arrow keys to select a method. The default is loop start.

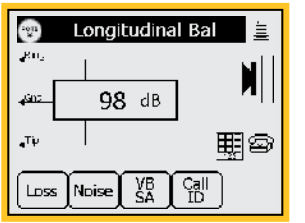
Press **OK** to return to the main Dial LB screen.



e. Press **Dial** to begin the test.



3. The results are displayed on the screen.



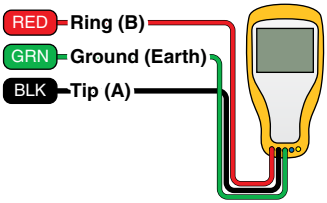
POTS Longitudinal Balance Normal Range

Parameter	*OK*	*Marginal*	*Not OK*
Balance	> 60	50–60	< 50 dB
Loss	< 6	6–8.5	> 8.5 dBm
Noise	< 20	20–30	> 30 dBmC

*POTS>**Load Coils***

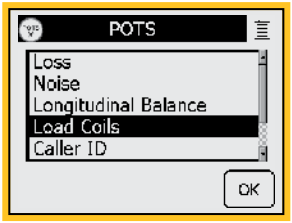
The **Load Coils** function counts up to five load coils on the pair and determines the distance to the first one. The distance measurement requires that you specify the wire gauge of the pair.

POTS>Load Coils>**Hook-Up**

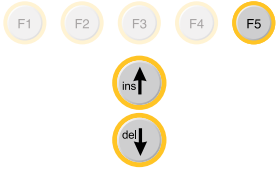


POTS>Load Coils>**Operation**

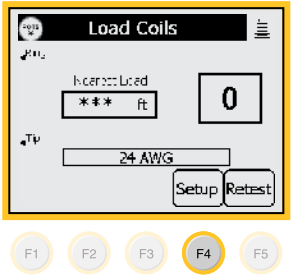
1. Press the blue key to enter POTS menu. Use the up and down arrow keys select Load Coils.



2. Press OK to see the Load Coil screen.

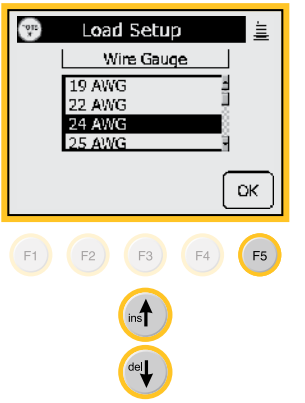


3. Press Setup to see the Load Coil Setup Screen.

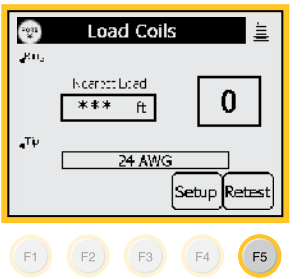


4. Use the up and down arrow keys to select the correct wire gauge.

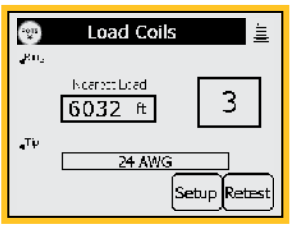
   Press OK to return to Load Coil screen.



5. Press Test to start the test.



6. The results show 3 load coils and the first load coil is at a distance of 6,032 feet.



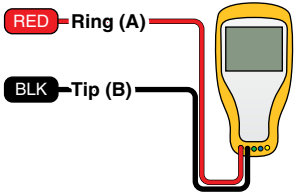
POTS>Load Coils>**Operation**

7. It is not necessary to have any particular length of cable before the first load coil, but you must have at least 3,000 feet of cable after each load coil for the Load Coil function to count properly.

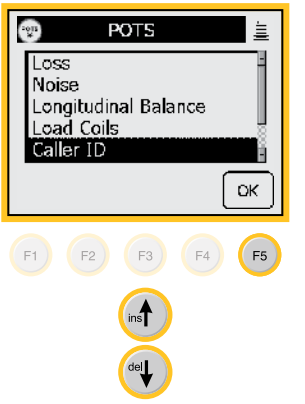
POTS>**Caller ID**

Caller ID detects the Caller ID signal sent on the pair and displays date, time, the calling number, the calling party name, the signal level, and the message status.

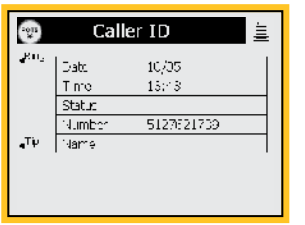
POTS>Caller ID>**Hook-Up**



1. Press the blue key to enter the POTS menu. Use the up and down arrow keys to select Caller ID.
2. Press OK to start the test.



3. The results of the test will be displayed on this screen.

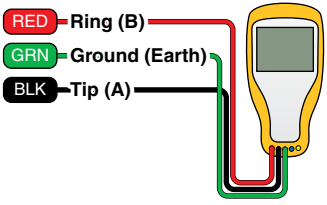


Certain result boxes may be blank if the information is not available.

POTS>**Ringers**

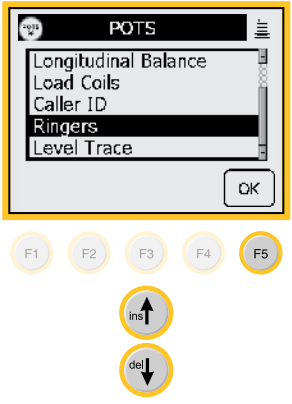
The **Ringers** function measures the capacitance associated with one or more ringer circuits on the line. One old style mechanical ringer has a capacitance of 0.47 µF. Newer phones have electronic ringers that have much lower capacitance than 0.47 µF

POTS>Ringers>**Hook-Up**



POTS>Ringers>**Operation**

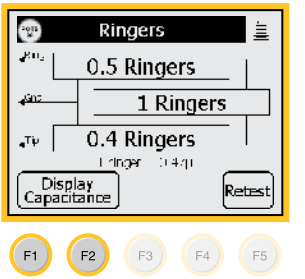
1. Press the blue POTS key to enter the POTS menu. Use the up and down arrow keys to select Ringers.
2. Press OK to start the measurement.



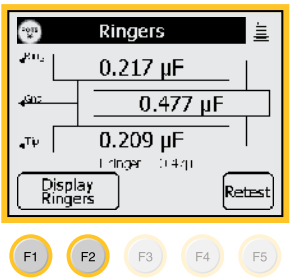
*POTS>Ringers>**Operation***

3. During the measurement an hour glass will be visible at the bottom of the display. When the measurement is complete, the Ring-Ground, Tip-Ring and Tip-Ground ringers will be displayed.

   To display the equivalent capacitance count, press **Display Capacitance**.



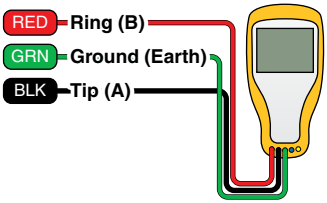
4. Press **Display Ringers** to return to the previous view.



*POTS>**Level Trace***

Use **Level Trace** to measure and display the AC impedance of an inactive pair as a function of frequency. This test can be used to analyze a pair for loading and bridge tap problems. This is NOT a continuous test.

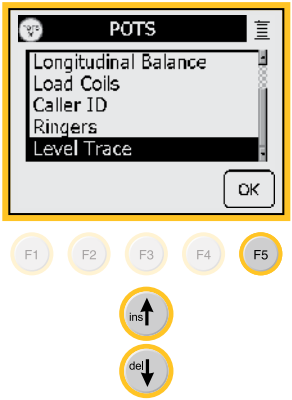
POTS>Level Trace>**Hook-Up:**



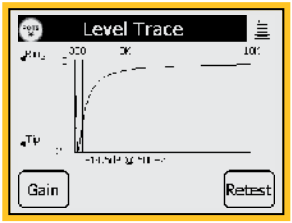
POTS>Level Trace>**Operation**

1. Press the blue key to enter POTS menu. Use the up and down arrow keys to select Level Trace.

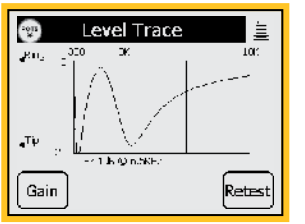
   Press OK to start the test.



2. The result is displayed on a graph with relative impedance level displayed on the y-axis (in dB) and the frequency on the x-axis. This trace shows a 12,000 foot line with no load coils.

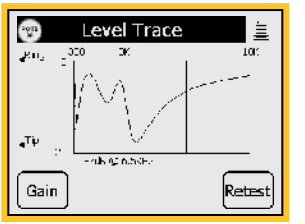


3. A dip in the graph indicates the presence of a load coil. This graph shows one load coil.

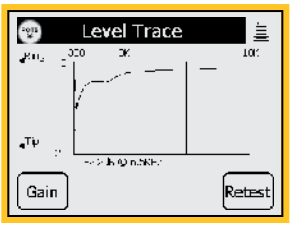


Note: Level trace cannot calculate the distance to the load coil.

4. Use the left and right soft keys to move the cursor across the graph. As the cursor is moved, a readout of the signal level and frequency will be displayed beneath the graph. This graph shows a circuit with two load coils.



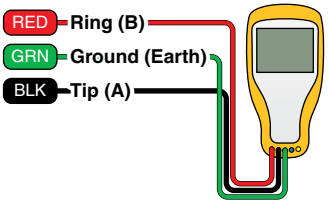
5. This trace shows one load coil at 18,000 feet.



POTS>**Kick Test**

Use the Kick Test function to continuously measure the voltage, resistance and opens length on a pair.

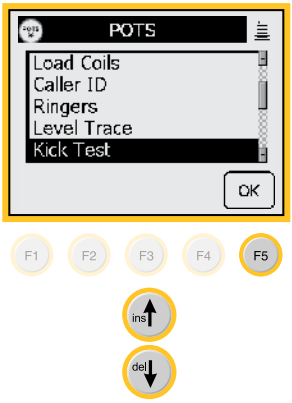
POTS>Kick Test>**Hook-Up**



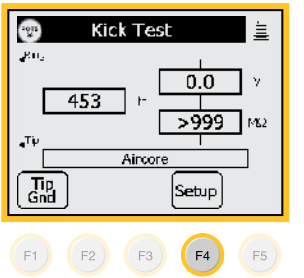
POTS>Kick Test>**Operation**

1. Press the blue POTS key to enter POTS menu. Use the up and down arrow keys to select Kick Test.

   Press OK to start the test.

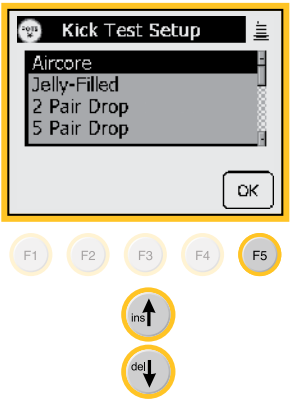


2. Press **Setup** to enter the type of cable.



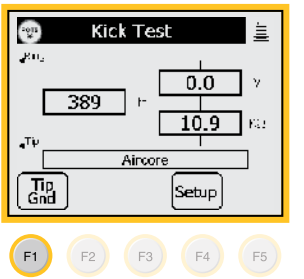
3. Use the up and down arrow keys to select the cable type.

   Press **OK** to start the test.



4. This screen displays the T-R measurements.

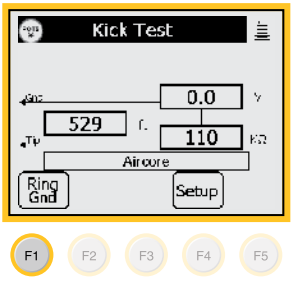
   Press **Tip Gnd** to see the T-G measurements.



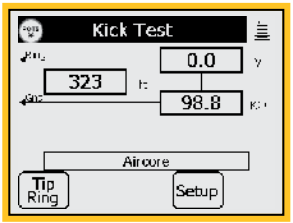
POTS>Kick Test>**Operation**

5. This screen displays the T-G measurements.

   Press **Ring Gnd** to see the R-G measurements.



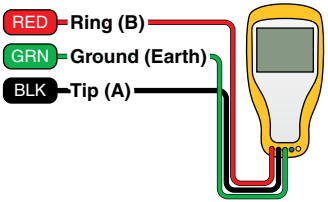
6. This screen displays the R-G measurements.



POTS>**Voice Band Spectrum Analyzer**

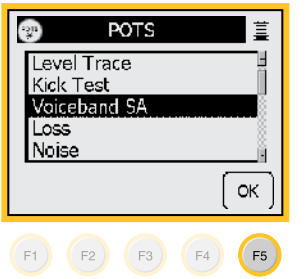
Use **Voice Band Spectrum Analyzer** to view a graph of useful signals and interference/noise in the low frequency range from 0 Hz to 2560 Hz.

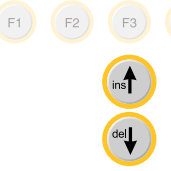
POTS>Voice Band Spectrum Analyzer>**Hook-Up**



1. Press the blue POTS key to enter the POTS menu. Use the up and down arrow keys to select Voiceband SA.

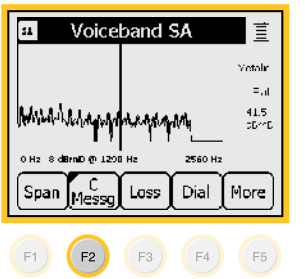
2. Press OK to start the measurement.





3. Move the cursor left or right to view individual frequencies.

   Pressing F2 will toggle between a flat filter and a C-message weighted filter.



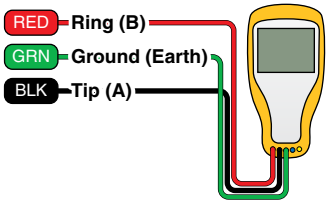
Auto Test

Use **Auto Test** AUTO to automatically perform the following tests: Active POTS, Vacant POTS, Vacant WideBand and Smart Auto Test.

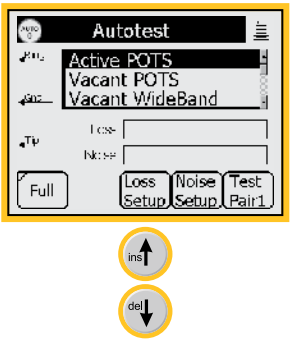
*Auto Test>**Active POTS***

Use **Active POTS** to perform an automatic sequence of tests on Active POTS lines. The tests include: DC Voltage, AC Voltage, Loop Current, Ground Resistance, Single Tone Loss, Voiceband Noise (metallic), Voiceband Power Influence and Longitudinal Balance.

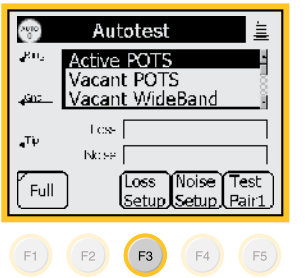
*Auto Test>Active POTS>**Hook-Up***



1. Press the blue AUTO 0 key to enter the Auto Test function. Use the up and down arrow to select Active POTS.

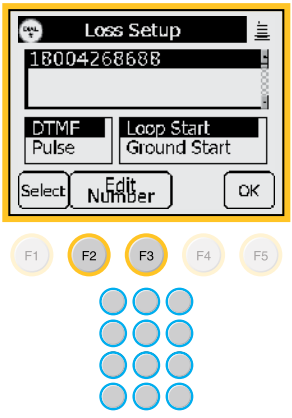


2. Press **Loss Setup** to set up the telephone numbers for the milliwatt line in the central office. You can store up to 10 different numbers for the central offices you work in.

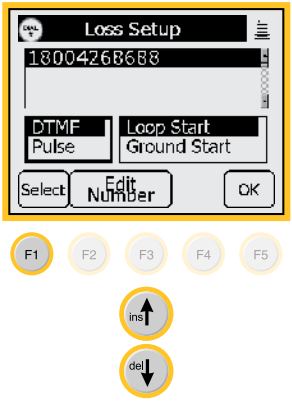


3. If you have entered telephone numbers in the Dial Loss function or the Talk Set function, they will be shown in the telephone number section.

   If you have not entered any telephone numbers in the Dial Loss function or the Talk Set function you can use [Edit Number] to enter the telephone number information with the blue keys.

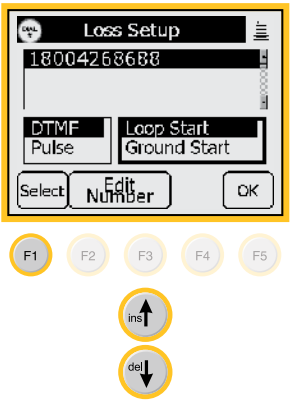


4. Press [Select] to move to the DTMF or Pulse dialing section. Use the up and down arrow keys to select a dialing method. DTMF is the default value.

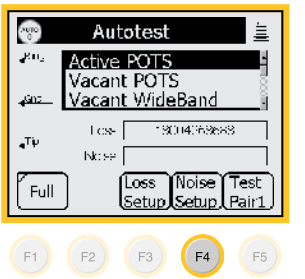


5. Press **Select** to move to the loop start-ground start section. Use the up and down arrow keys to select a method. The default is loop start.

   Press **OK** to return to the main Auto Test screen.

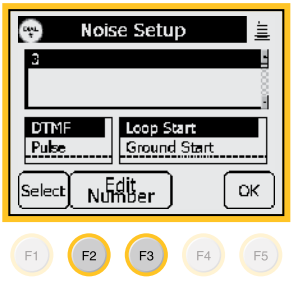


6. Press **Noise Setup** to setup the telephone numbers for the quiet line termination line in the central office.



7. ***Central Office with a combination milliwatt and quiet line termination:***

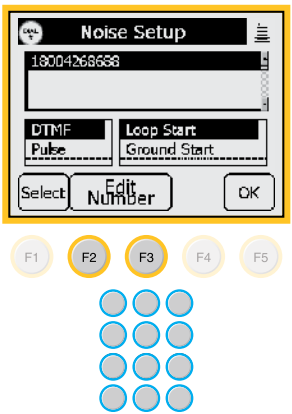
   Press [Edit Number] and enter a digit that is a valid first digit for the central office. This will break dialtone and the measurement will be taken as if it were a quiet line termination.



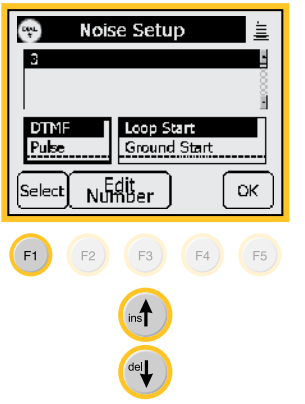
8. ***Central Office without a combination milliwatt and quiet line termination:***

   If you have entered telephone numbers in the Dial Loss function or the Talk Set function, they will be shown in the telephone number section.

   If you have not entered any telephone numbers in the Dial Loss function or the Talk Set function you can use [Edit Number] to enter the telephone number information with the blue keys.

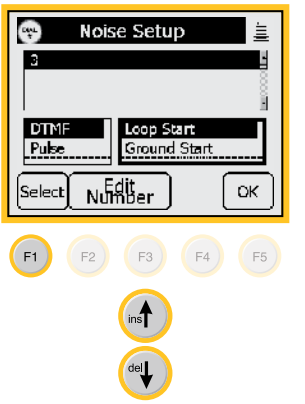


9. Press **Select** to move to the DTMF or Pulse dialing section. Use the up and down arrow keys to select a dialing method. DTMF is the default value.



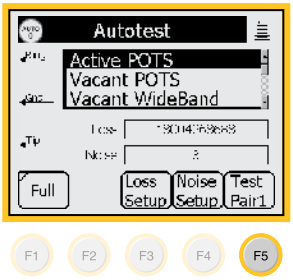
10. Press **Select** to move to the loop start-ground start section. Use the up and down arrow keys to select a method. The default is loop start.

    Press **OK** to return to the main Auto Test screen.



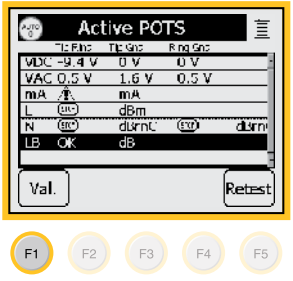
11. Press Test Pair 1 to start the Active POTS tests.

Note: The volume of the test can be adjusted using the up and down arrows.



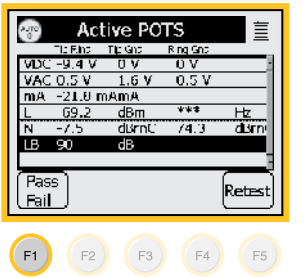
12. Certain auto test results are compared against pass/fail limits to provide a quick-look at the pair condition. The pass/fail status is indicated in the results box by an “OK” for pass, a “Yield” sign for marginal and a “Stop” sign for fail.

13. Press Val. to see the actual test results.



*Auto Test>Active POTS>**Operation***

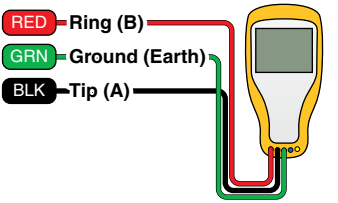
14. Press Pass/Fail to see only the OK, Yield, or Stop symbols.



*Auto Test>**Vacant POTS***

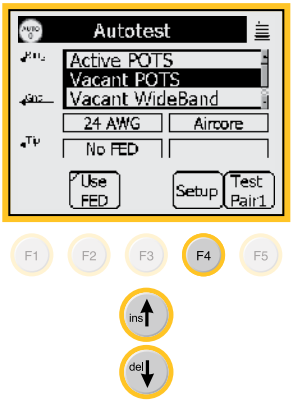
Use **Vacant POTS** to perform an automatic sequence of tests on Vacant POTS lines. When you use the 3M™ Dynatel™ Far End Device II 1342 or 1343, the tests include: DC Voltage, AC Voltage, DC Resistance, Opens, % Capacitance Balance, Load Coil, Voice Band Loss, Voice Band Noise, Power Influence, Longitudinal Balance, Slope, Resistance Balance (loop) and Resistance Balance (% diff).

*Auto Test>Vacant POTS>**Hook-Up***

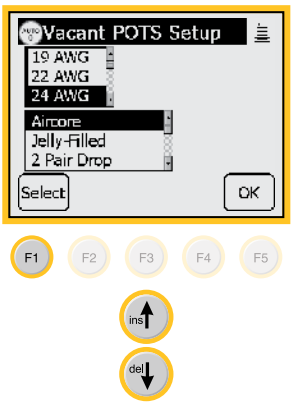


1. Press the blue AUTO key to enter the Auto Test function. Use the up and down arrow keys to select Vacant Pots.

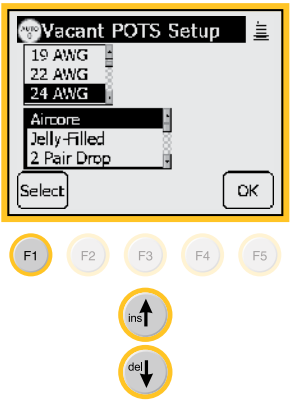
   Press **Setup** to choose the measurement parameters.



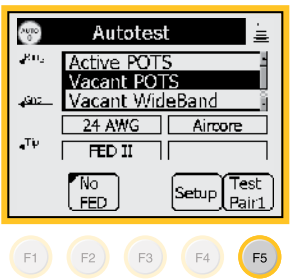
2. Press **Select** to select the gauge of your cable. Use the up and down arrow keys to select the gauge.

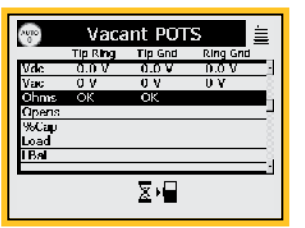


3. Press **Select** to move to the type of cable. Use the up and down arrow keys to select your type of cable.



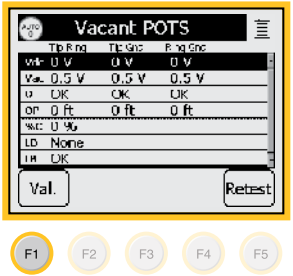
4. Press **OK** to return to the main Auto Test screen.
5. Using the 3M™ Dynatel™ Far End Device II can provide more information about your circuit. Press **Use FED** to use the far end device.
6. Press **Test Pair 1** to start the test.
7. The screen will display the results of the measurements.



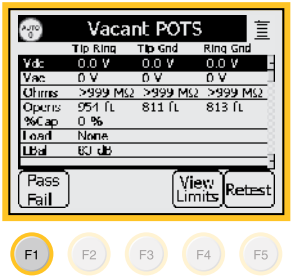


8. Certain auto test results are compared against pass/fail limits to provide a quick-look at the pair condition. The pass/fail status is indicated in the results box by an “OK” for pass, a “Yield” sign for marginal and a “Stop” sign for fail.

9. Press **Value** to see the actual test results.



10. Press **Pass/Fail** to see only the OK, Yield, or Stop symbols.



*Auto Test>***Vacant Wideband**

Use **Vacant Wideband** to perform an automatic sequence of tests on Vacant Wideband circuits. The tests include: DC Voltage, AC Voltage, DC Resistance, Opens, % Capacitance Balance, Load Coil, Wideband Loss, Wideband Noise, Longitudinal Balance, Slope, Resistance Balance (loop) and Resistance Balance (% diff).

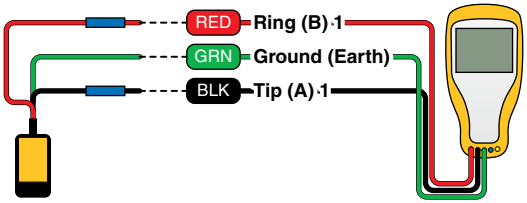
Note: You must use a 3M™ Dynatel™ Far End Device II 1342 or 1343 to use the Vacant Wideband function.

Insertion Loss Frequencies and Sweep Frequencies by Service Type

Insertion Loss Sweeps	***Single Frequency****	***Sweep Frequencies***
Pots	1004 Hz	404, 804, 1004, 1204, 1404, 1604, 1804, 2004, 2804, 3004 (Hz)
56k	28 kHz	20, 28, 32, 40, 48, 82 (kHz)
64k	32 kHz	20, 28, 32, 40, 48, 82 (kHz)
ISDN	40 kHz	20, 28, 32, 40, 48, 60, 70, 82 (kHz)
HDSL	196 kHz	20, 30, 50, 70, 90, 110, 130, 196, 400 (kHz)
T1	772 kHz	200, 400, 500, 700, 772, 1024 (kHz)
E1	1024 kHz	200, 400, 500, 700, 772, 1024 (kHz)
ADSL	138 kHz	20, 30, 50, 69, 90, 110, 138, 276, 400, 600, 800, 1000, 1100 (kHz)
H2/4ACC	196 kHz	50, 80, 130, 196, 250, 300, 350 (kHz)
H4RACC**	N/A	20, 30, 50, 70, 90, 110, 130, 196, 400 (kHz)
H4NACC***	N/A	20, 30, 50, 70, 90, 110, 130, 196, 400 (kHz)
ADSL2	138 kHz	20, 30, 50, 69, 110, 138, 276, 400, 600, 800, 1100, 1500, 1800, 2200 (kHz)

** Pass/Fail provided for Single Frqeuency when measuring just Single Frequency or in Sweep Mode.*
*** Pass/Fail provided for 50 kHz, 90 kHz and 130 kHz*
**** Pass/Fail provided for 50 kHz, 90 kHz, 130 kHz and 196 kHz*

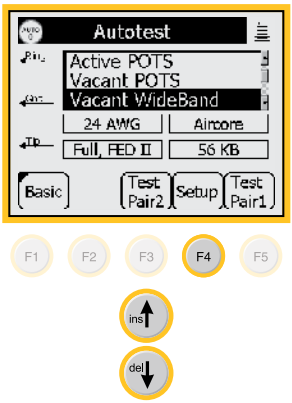
Auto Test>Vacant Wideband>**Hook-Up**



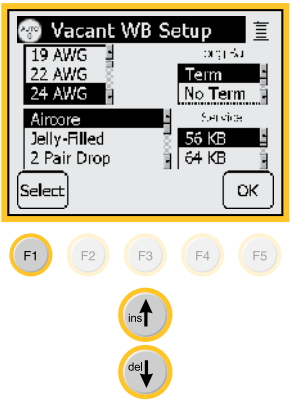
Auto Test>Vacant Wideband>**Setup**

1. Press the blue AUTO 0 key to enter the Auto Test function. Use the up and down arrow keys to select Vacant Wideband.

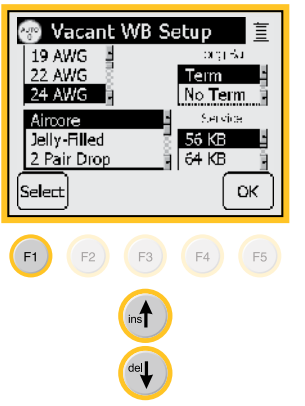
   Press **Setup** to choose the measurement parameters.



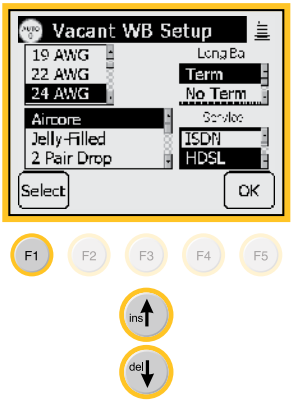
2. Press **Select** to select the gauge of your cable. Use the up and down arrow keys to select the gauge.



3. Press **Select** to move to the type of cable. Use the up and down arrow keys to select your type of cable.

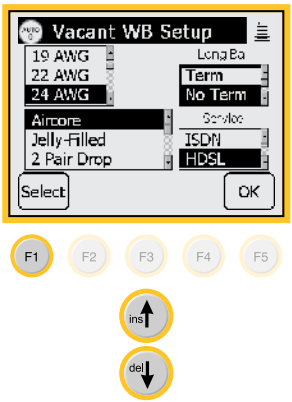


4. Press **Select** to move to the service type. Use the up and down arrow keys to choose the type of service.

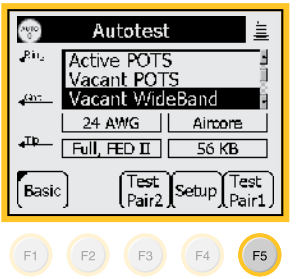


5. Press **Select** to move to the termination type. Use the up and down arrow keys to choose the termination.

   Press **OK** to return to the main Auto Test screen.

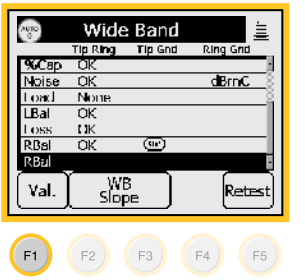


6. Press **Test Pair 1** to start the test.

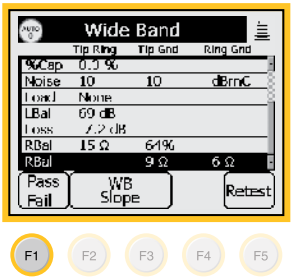


7. Certain auto test results are compared against pass/fail limits to provide a quick-look at the pair condition. The pass/fail status is indicated in the results box by an “OK” for pass, a “Yield” sign for marginal and a “Stop” sign for fail.

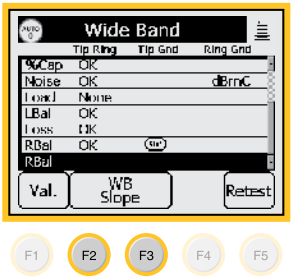
8. Press **Val.** to see the actual test results.



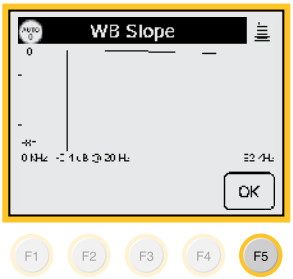
9. Press **Pass/Fail** to see only the OK, Yield, or Stop symbols.



10. Press **WB Slope** to see the graph of the slope.



11. Press **OK** to return to the main Test Results screen.



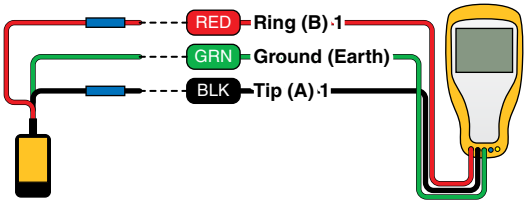
*Auto Test>**Expert Pair Test***

Use the **Expert Pair Test** to detect, identify and locate the most common pair faults without having to change test leads. In most situations, the 3M™ Dynatel™ Far End Device II 1342 or 1343 (FED) is required to provide the most complete information.

*Auto Test>Expert Pair Test>**Features***

	Identification with FED	Location with FED	Identification w/o FED	Location w/o FED
Working Pair	Yes	NA	Yes	NA
Good Pair	Yes	Length	Yes	Length
T/R Reversal	Yes	No	No	No
Light T/R Short	Yes	NA	Yes	No
Solid T/R Short	Yes	Yes	Yes	Yes
Solid T-Ground	Yes	Yes	Yes	No
Solid R-Gound	Yes	Yes	Yes	No
High T-Ground	Yes	Yes	Yes	No
High R-Ground	Yes	Yes	Yes	No
T-Battery Cross	Yes	Yes	Yes	No
R-Battery Cross	Yes	Yes	Yes	No
T-Complete Open	Yes	Yes	Yes	Yes
R-Complete Open	Yes	Yes	Yes	Yes
T&R-Complete Open	Yes	Yes	Yes	Yes
T-Partial Open	Yes	Yes	Yes	Yes
R-Partial Open	Yes	Yes	Yes	Yes
T&R Partial Open	Yes	Yes	Yes	Yes

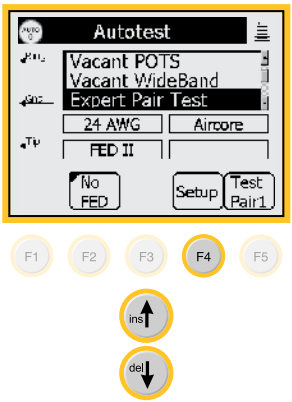
Auto Test>Expert Pair Test>**Hook-Up**



Auto Test>Expert Pair Test>**Operation**

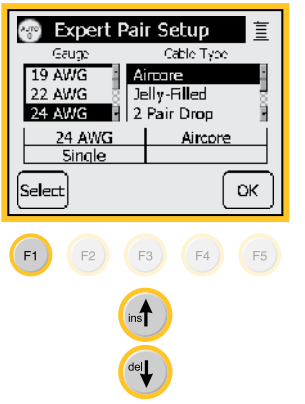
1. Press the blue AUTO key to enter the Auto Test function. Use the up and down arrow keys to select Expert Pair Test.

   Press Setup to choose the measurement parameters.



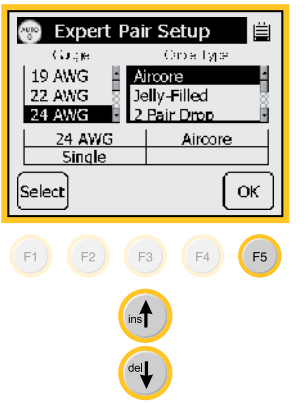
2. Use the up and down keys to select the wire gauge.

   Press Select.

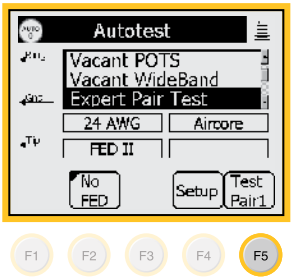


3. Use the up and down keys to select the type of cable.

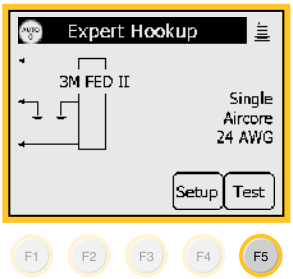
   Press OK.



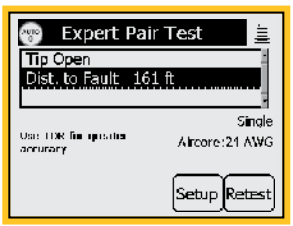
4. Press Test Pair 1.



5. Review the screen for the correct setup information. Press Test to start the test.



6. Test results.

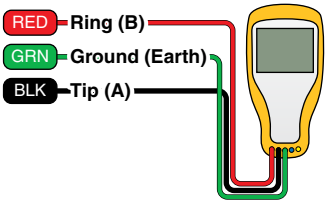


7. Use ESC to exit this screen. Wait for the 3M™ Dynatel™ Far End Device II to reset before you choose another screen.

Talk Set

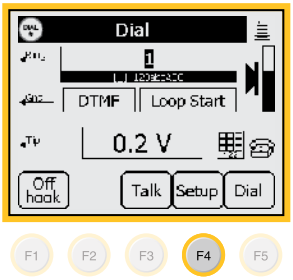
The **Talk Set** function allows you to use the 965AMS tester as a talk set on an active line to send DTMF or pulse dialing.

Talk Set>**Hook-Up**



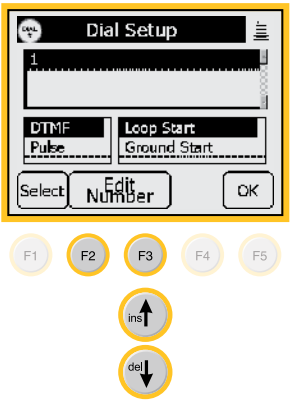
Talk Set>**Setup**

1. Press the blue key to start this function.
2. Press Setup.



3. Use the up and down arrow keys to choose one of the 10 memory locations. These locations are not numbered.

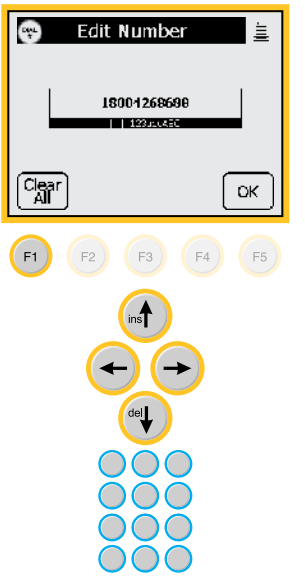
4. Press **Edit Number**.



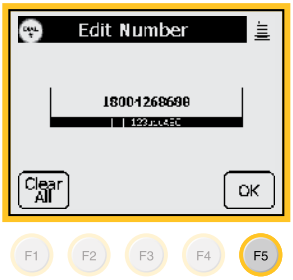
5. Use the blue keys to enter the phone numbers. Use the left and right arrow keys to position the number as needed.

6. Use the up and down arrows to insert or delete numbers.

7. Press **Clear All** to remove all numbers from this entry.



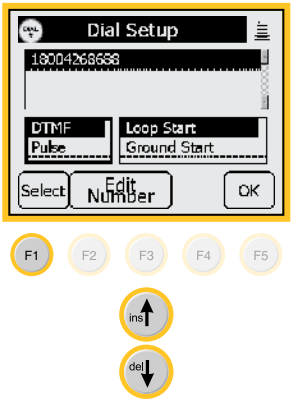
8. Press OK to save this phone number.



9. Press Select to choose the type of pulsing.

   Use the up and down arrow keys to choose DTMF or Dial Pulse. DTMF is the most common.

10. Press Select again to choose the type of dial tone start mode.

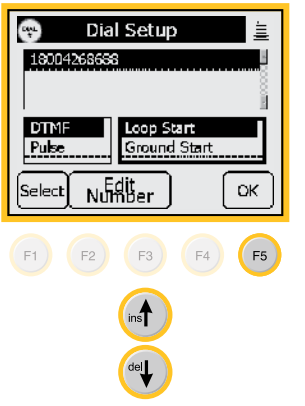


*Talk Set>**Setup***

11. Use the up and down arrow keys to choose between Loop Start and Ground Start. Loop Start is the most common.

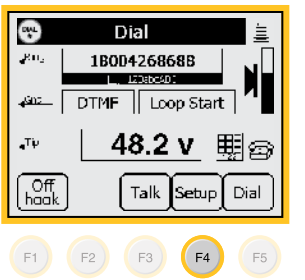
    Note: Ground start requires the green test lead to be connected to a grounded shield.

    Press OK to complete the setup.

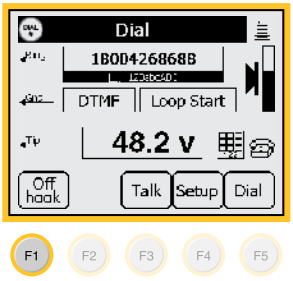


*Talk Set>**Operation***

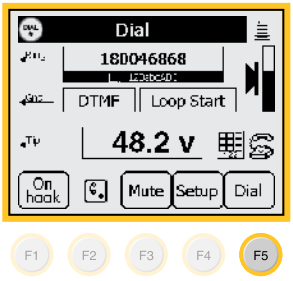
1. This screen shows the last number dialed, the DC voltage on the line and the signal format for dialing. You can use the previously dialed number, enter a new number using the blue keys, or press Setup to use the stored number list.



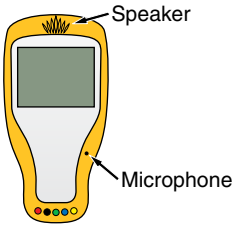
2. Press **Off Hook** to draw dial tone.



3. Press **Dial** to dial the number.



4. The speaker and microphone are located on the front of the unit.

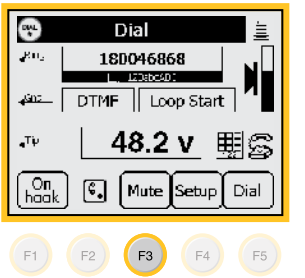


5. The up and down arrow keys adjust the receiver volume.

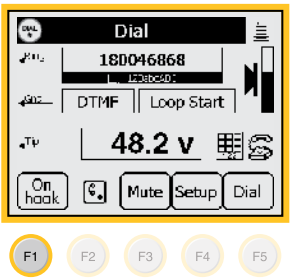
*Talk Set>**Operation***

6. Press [Mute] to mute the microphone.

   Press [Talk] to un-mute.



7. Press [On Hook] to end the call.



*Talk Set>**Applications***

1. This function can be used as a butt set to dial out or to receive incoming ringing tone.

2. You can also use this function as a talk circuit on an inactive pair. Multiple 965AMS units can be bridged together on the pair. Each tester supplies its own talk battery. You cannot use the talk function and any other function at the same time.

Care & Maintenance

System Modes

1. The 965AMS tester is a microcomputer-controlled device that is very similar to a laptop computer. The tester will be in one of 3 modes: Active, Standby, or Power Down.

2. **Active Mode:** Press the red  key to wake-up the tester. It is ready to use. The amount of time the tester will stay in the active mode without pushing a key is controlled by the Power-Down Timeout setting. Your choices are 5, 10 and 15 minutes.

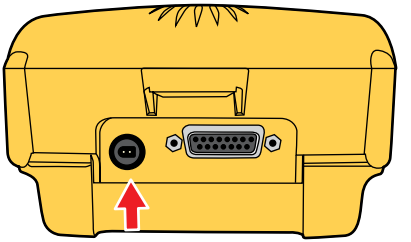
3. **Standby Mode:** When you finish using the tester, press the red  key to go into the Standby Mode.

4. **Power Down Mode:** This mode uses a very small amount of power. This mode is recommended for extended down time such as overnight or weekends and vacations. To power down the tester, press and hold the red  key for 10 seconds to go into Power Down Mode.

Note: The tester is still using battery in Standby Mode. To preserve battery life it is recommended that you power down the tester overnight.

AC Charger

Use the AC charger to charge the NiMH battery pack. Plug the AC cord into the AC charger and into a power outlet. Plug the DC cord into 965AMS tester. Make sure that the key on the plug fits properly into the slot in the connector. The AC charger is meant for charging the NiMH battery pack only.



Charging efficiency is best with a temperature between 50°F (10°C) and 86° F (30°C).

Note: Do not charge the batteries at temperatures below 32°F (0°C) or above 86° F (30°C).

DC Charger

Use the Cigarette Lighter Adapter to charge the NiMH battery pack from a vehicle's battery. This adapter is meant for charging the NiHM battery pack only and should not be used to power the 965AMS tester during normal operations.

Charging efficiency is best with a temperature between 50°F (10°C) and 86° F (30°C).

Note: Do not charge the batteries at temperatures below 32°F (0°C) or above 86° F (30°C).

Level of Charge

The battery icon in the upper right of all screens indicates the battery charge. Four black bars in the icon indicate full charge. Zero black bars indicate the battery pack is very low and should be charged immediately. A warning screen appears when there are only five minutes charge left.

System Reset

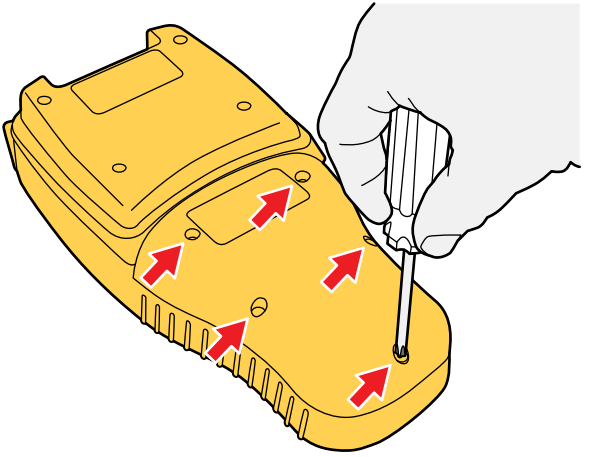
Situations were the batteries run down and the unit will not power up may require you to reset the unit using this procedure:

1. Charge the internal battery pack or use the “AA” battery pack with new batteries.
2. Press and hold the ON/OFF ① key for 10 seconds.
3. Release the ON/OFF ① key, and press again for 1 second.
4. Files will appear loading on the screen after about 20 seconds.
5. When the main screen appears, the unit is ready to use.

Battery Pack

The 965AMS tester uses a Nickel Metal Hydride (NiMH) battery pack. Typical life of battery pack is two years. To change the battery pack:

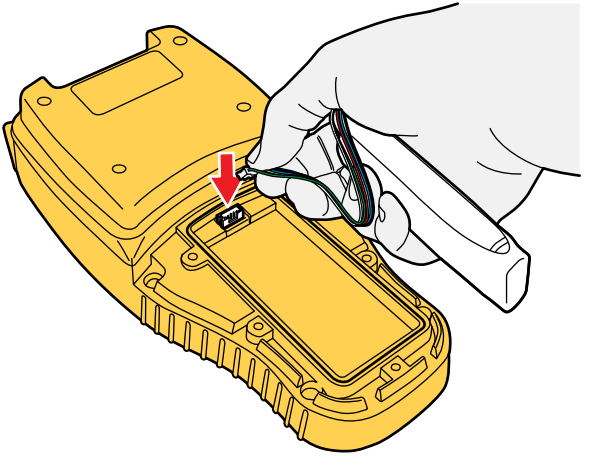
1. Power down the unit.
2. Place the unit upside down on a soft surface. Loosen the 5 screws.



3. Remove the battery cover.
4. Unplug the battery connector.

Battery Pack

5. Plug in the new battery connector.



6. Place the battery in the compartment.
7. Replace the cover.
8. Tighten the screws.

Caution: Battery may explode, leak or catch fire if exposed to high temperatures or fire. Recycle or dispose of properly. To prevent injuries or burns, do not allow metal objects to contact or short circuit the battery terminals.

Note: NiMH batteries should be recycled if disposal services are available.

Battery Holder

The plastic battery holder that comes with the unit uses six "AA" alkaline batteries (alkaline batteries are not included).

Use alkaline batteries only when the NiMH battery pack is discharged and the AC adapter is not available. Typical lifetime of the alkaline battery pack is twenty hours of normal use (less if you use the backlight frequently, use the optional /SA or /ADSL features heavily, or work in very cold weather). The alkaline battery pack is installed the same way as the NiMH battery pack.

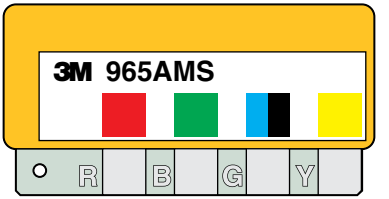
Note: The battery holder has protection against accidental charging of alkaline batteries.

Test Leads

The 965AMS tester comes with a Red/Black test lead pair, a Blue/Yellow test lead pair, and a separate Green test lead. The Red/Black and Green test leads are used for most measurements. The Blue/Yellow lead pair is used with some TDR modes (not in the 965AMS-B tester), and the Yellow lead is used with RFL. The shorting "strap" that comes with the unit is used with RFL. Keep the test leads clean and dry at all times to insure best accuracy of the measurements. Use soap and water to clean them if necessary.

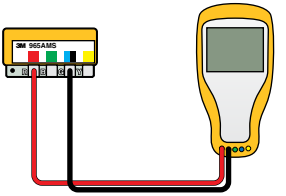
Self-Test Board

A self-test board is included with the 965AMS tester to verify the performance of Opens and RFL. This is particularly important if operating conditions (shock, temperature, etc.) have changed and you want to check the function accuracy.



*Self-Test Board>**Check Opens***

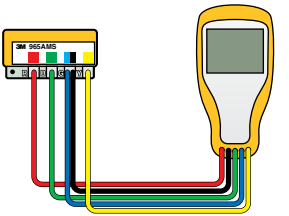
1. Connect the test leads as shown. Press the OPEN 5µH / 5µH key on the 965DSP/SA tester. You should see the following readings for different types of cable (US and Canada).



Measurement		Capacitance	Aircore	Jelly-Filled
Black to Red or Black to Green	Min	9.35 nF	395 ft (120 m)	350 ft (107 m)
	Max	0.011 uF	450 ft (137 m)	400 ft (122 m)
Red to Black	Min	9.35 nF	595 ft (181 m)	595 ft (181 m)
	Max	0.011 uF	680 ft (207 m)	680 ft (207 m)

*Self-Test Board>**Check RFL Performance***

1. Connect the test leads as shown. Press the RFL 7pqrs key on the 965AMS tester.



2. Press the Setup key, enter 70°F (21°C) for temperature.
3. Press the OK key to accept.
4. Select Separate Pair hookup, then continue. You should see the following readings for different wire gauges (US and Canada).

AWG	DTS		DTF		DSTF	
	Min	Max	Min	Max	Min	Max
19	11910 (3630)	12290 (3747)	1170 (357)	1230 (375)	10730 (3271)	11070 (3375)
22	5986 (1825)	6171 (1881)	592 (180)	613 (187)	5393 (1644)	5559 (1695)
24	3755 (1145)	3871 (1180)	371 (109)	385 (117)	3383 (1031)	3488 (1063)
25	2970 (905)	3063 (934)	293 (89)	305 (93)	2676 (816)	2759 (841)
26	2347 (716)	2420 (738)	232 (71)	240 (73)	2114 (645)	2180 (665)
28	1479 (451)	1526 (465)	146 (44)	152 (46)	1332 (406)	1375 (419)
Ohms	99.3	102.5	9.8	10.2	89.5	92.3

Specifications

Electrical Specifications

Functions	Range	Resolution	Accuracy
Voltage (DC)	0 to 99.9 V 100 to 300 V	0.1 V 1 V	1% ± 0.5 V 3%
Voltage (AC) Meter resistance 100 k or 1 m	0 to 99.9 V 100 to 250 V	0.1 V 1 V	1% ± 0.5 V 3%
Current Shunt resistance	0 to 59.9 mA 60 to 110 mA 430 Ω	0.1 mA 0.1 mA	1% ± 0.3 mA 2%
Resistance With CO voltage	0 to 9999 Ω 0 to 9999 Ω 10 k to 99.9 kΩ 100 k to 999 kΩ 1 M to 9.9 MΩ 10 M to 99 MΩ 100 M to 990 MΩ	1 Ω 1 Ω 0.1 kΩ 1 kΩ 10 kΩ 0.1 MΩ 1 MΩ	1% ± 5 Ω 1% ± 50 Ω 1% 3% 3% 5% 10%
Opens (no noise)	0 to 3,000 ft (0 to 1,000 m) 3,000 to 10,000 ft (1 km to 3 km) 10,000 to 50,000 ft (3 km to 15 km) 50,000 to 100,000 ft (15 km to 30 km)	1 ft (1 m) 1 ft (1 m) 10 ft (10 m) 100 ft (100 m)	1% ± 3 ft (1 m) 3% 5% 10%
RFL Fault range Resistance to Fault (no noise)	 0 to 20 MΩ 0 to 99.99 Ω 100 to 999.9 Ω 1 k to 3 kΩ	 — RTS 0.01 Ω RTS 0.1 Ω RTS 1.0 Ω	 — 0.1% of RTS ± 0.01 Ω[1] 0.2% of RTS ± 0.01 Ω[1] 1.0% of RTS ± 0.01 Ω[1]
Wet section test Loop resistance Resistive balance	 0 to 7 kΩ 0 to 3.5 kΩ	 — —	 — 5%
Loop resistance	0 to 99.9 Ω 100 to 999.9 Ω 1000 to 7000 Ω	0.01 Ω 0.1 Ω 1 Ω	0.1% ± 0.01 Ω 0.2% ± 0.01 Ω 1.0% ± 0.01 Ω
Resistance difference	0 to 99.99 Ω	0.01 Ω	1% of loop resistance ± 0.01 Ω

Note: *[1]All resistance to fault measurement accuracies have an added factor of $(2x10^{-8})$ R_f ohms (R_f =fault resistance in ohms)*

Electrical Specifications

Functions	Range	Resolution	Accuracy
Tone output			
ID tone	200 to 1000 Hz, fixed level	8 volt peak to peak	+1 Hz
Precision tone-600 Ω Zout	200 to 9999 Hz, -20 to +1 dBm	1 Hz, 0.1 dB	1% Hz, 0.2 dB
	10 k to 19.99 kHz, -20 to +1 dBm	1 Hz, 0.1 dB	2% Hz, 1 dB
Ringers	0.0 to 4.0 ringer 0 to 2000 nF	0.1 ringer 10 nF	
Load coil count	0 to 5	1	±1 load coil
Ground resistance	5 to 500 Ω	1 Ω	1% ± 1 Ω
Ohms/distance calculator	0-9999 Ω 0-99999 ft (0-30 km)	0.01 1 ft (0.1 m)	— —
TDR			*
Ranges	100 ft, 200 ft, 500 ft, 1,000 ft, 2,000 ft, 5,000 ft, 10,000 ft, 20,000 ft, 30,000 ft (30 m, 60 m, 150 m, 300 m, 600 m, 1.5 km, 3km, 6 km, 10 km)	1 ft (1 m)	0.3% range
		5 nS, 34 nS, 135 nS, 1660 nS, 600 nS	Fixed values
Velocity input	0.50 to 0.99 (150 to 299 m/µs)	—	—
Modes	Single trace, dual trace, differential, memory, crosstalk, peak, memory diff.	—	—
Loss (and frequency)	-40 to +10 dBm, 200 to 3000 Hz,	0.1 dB, 1 Hz,	±0.5 dB, 2 Hz
With 600 Ω Zin	-40 to +10 dBm, 3000 to 9995 Hz,	0.1 dB, 10 Hz	±0.5 dB, 10 Hz
	-40 to +10 dBm, 10 k to 19.9 kHz	1 dB, 10 Hz	±1 dB, 20 Hz
Noise metallic 600 ΩZin C and psophometric	0 to 50 dBrnc (-90 to –40 dBm0p)	1 dB	±2 dB
Noise to ground 600 ΩZin	40 to 100 dBrnc (-50 to 10 dBm0p)	1 dB	±2 dB
Longitudinal balance	0 to 85 dB	1 dB	±2 dB
Dial mode	DTMF, pulse	Standard	Standard

Electrical Specifications

Functions	Range	Resolution	Accuracy
Caller ID (U.S. and Canada only)	Date, time, number, name	—	
Carrier level	-4 to –32 dBm	1 dBm	±2 dBm
Short range wideband specifications (without SA option)			
Wideband loss 100, 135 Ω Zin	-50 to +2 dBm, 20 kHz to 1.2 MHz	0.1 dB, 100 Hz	±2 dB, 1% Hz
Wideband tone output–100,135 Ω Zout	0 dBm, 20 k to 2.2 MHz	1 kHz	±+1 dB
SA wideband specifications (with SA option)			
Wideband loss 100, 135 Ω Zin	-85 to +5 dBm, 20 kHz to 2.2 MHz	0.1 dB, 100 Hz	±1 dB, 1% Hz
Wideband noise metallic			
100, 135 Ω Zin	E filter 10-90 dBm	1 dB	±2 dB
E, F, G & G2 filters	F filter 20-90 dBm	1 dB	±2 dB
	G filter 30-90 dBm	1 dB	±2 dB
Wideband spectral analysis			
100, 135 Ω Zin	10 kHz to 2.2 MHz	0.5% of span	1%
Dynamic range	–90 dBm to +10 dBm	1 dB	
Wideband tone output –100,135 Ω Zout	0 dBm, 20 kHz to 2.2 MHz	1 kHz	±1 dB ±0.1% frequency ±0.5 kHz
Impulse noise counting E, F, G & G2 filters			
Counting interval	1-60 minutes	1 minute	±5%
Threshold	Lower limits: 30 dBrnC & E 40 dBrnF 50 dBrnG 100 dBrn upper limit All 30 dB higher for N to Ground	1 dB	±1 dB (typical)
Count capacity	9999	1	—
Filters: C, E, F, G, G2 and Psophometric for OUS	E filter F filter G filter G2 filter	300 Hz – 3400 Hz 1 kHz – 50 kHz 4.9 kHz – 245 kHz 20 kHz – 1.1 MHz – 3 dB points 20 kHz – 2.2 MHz	
Stored results (All Results)	100 results total of all types maximum		

General Specifications

Drop test	Survives 3 ft (1 m) drop onto concrete, (survives 5 ft drop onto concrete with soft case) using ASTM D4169 assurance level I method 5276
Vibration	Meets Mil 810F method 514.5
Water, dust and chemical proof	Meets IP65 per IEC 529(1989) for rain and dust Immersion test IP67 0.15 m deep
Emissions	Standards meet FCC part 15, class A: Digital Devices for the US, and EN55022 (radiated emissions)
Built to ISO9001/2000 certification for manufacturing facilities and TL 9000 compliant	
Built to ANSI/IPC A610-C manufacturing standards	
Language	English, Spanish, and French Canadian
Units	Feet or meters, Fahrenheit or Celsius, dBrnC or dBm0p, m/uS or Vp
Battery	Rechargeable battery pack or alkaline, 9 hours typical use (50% on/off measures voltage)
Display	4.1" x 3.1"(104 x 79 mm), 320 x 240 pixel resolution, high visibility in bright sunlight
Operating temperature	0° to 140°F (-18 to 60°C)
Storage temperature	-40° to 165°F (-40 to 75°C)
Moisture: rain, water and humidity proof	Meets or exceeds IP65, IP67

Note: *Routine lab calibration is not recommended or required*

Contact 3M

Customer and Technical Support: 1-800-428-8688

Repair Center: 1-800-426-8688, option 2

This is the EU symbol for equipment that is covered under the Waste from Electrical and Electronic Equipment (WEEE) directive per CENELEC Specification 5041. It indicates that certain products should not be discarded in the trash, but rather should be recycled. This applies to all electronic pluggable and battery powered products.

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